Syllabus for B.Sc. in Electronic and Telecommunication (ETE) Engineering Program

Department of Electrical and Electronic Engineering

United International University

2014

REVISED SYLLABUS FOR B.SC. IN
Electronic and Telecommunication Engineering (ETE)

Rapid development in the fields of electronics and communication over the last decade has made Electronic and Telecommunication Engineering an emerging field of specialization. Bachelor of Science in Electronic and Telecommunication Engineering primarily involves the study of a number of core courses which every electronic and telecommunication engineer should know and few courses from specific specialized areas. Although this program is a specialized one, still there is scope of optional courses in the final year for the students to choose other subjects of further interest. Core courses build the foundation and specialized courses prepare the students for the specific areas of electronics and communication. To understand the underpinning theory of the courses of Electronic and Telecommunication Engineering, a number of courses on Mathematics and basic science, e.g., Physics, Chemistry etc. have been felt mandatory to include in the syllabus. In addition some social science, management, accounting, economics and communication-skills development related courses have been incorporated to make the syllabus a balanced and reasonably complete one. The objective of the undergraduate program in Electronic and Telecommunication Engineering is to develop skilled and competent graduates to meet the current and future needs at home and abroad. After the completion of the B.Sc. in ETE, the engineers can carry on their endeavor in the practical fields of industry, such as telecommunication, semiconductor processing, circuit design, etc., and can also pursue higher studies to involve in the state-of-the-art research.

Admission Requirements

Every applicant, without any exception, must fulfill the admission requirements as laid down by UIU. Admission test and interview for admission into the first semester will be held thrice a year as decided by UIU. No interim or supplementary admission test or interview will be arranged.

A higher secondary certificate or its equivalent in science with mathematics and physics or other fields of study is the basic educational requirement.

Admission Test

Applicants will be required to sit for an admission test designed to judge their abilities and aptitude for the program. The test will be held as arranged by UIU. The admission test will be held on the following three areas:

i. Language and Communication
ii. Mathematics and Physics
iii. Analytical ability

To qualify in a written test an applicant is required to obtain a minimum mark in all the three sections separately.

Degree Requirements

The B.Sc. in ETE degree requirements will be as follows:

(a) Completion of 140.5 credit hours
(b) Completion of the project with at least a 'C' grade
(c) Passing of all courses individually and maintaining a minimum CGPA of 2.25

SEQUENCE OF COURSE OFFERINGS IN TWELVE TRIMESTERS:

Trimester 1

Sl. No.	Course Code	Course Title	Credit Hr.
1.	ENG 101/ ENG 002*	English I or Pre-English	3.00*
2.	MATH 003	Elementary Calculus	3.00
3.	PHY 101	Physics I	3.00
		Subtotal	6 or 9

*Non-credit mandatory course with 3 contact hours.
** 06 for Pre-English and 09 for English I

Trimester 2

Sl. No.	Course Code	Course Title	Credit Hr.
1.	MATH 151	Differential and Integral Calculus	3.00
2.	EEE 101	Electrical Circuits I	3.00
3.	PHY 103	Physics II	3.00
4.	PHY 104	Physics Lab	1.00
5.	ENG 103/ ENG 101	English II/English I	3.00
		Subtotal	13.00

Trimester 3

Sl. No.	Course Code	Course Title	Credit Hr.
1.	EEE 103	Electrical Circuits II	3.00
2.	EEE 104	Electrical Circuits Lab	1.00
3.	ACT 111	Financial and Managerial Accounting	3.00
4.	MATH 155	Ordinary and Partial Differential Equations	3.00
5.	ENG 103	English II	3.00
		Subtotal	10.00 or 13.00**

** 10.00 without English II and 13.00 with English II

Trimester 4

Sl. No.	Course Code	Course Title	Credit Hr.
1.	EEE 105	Electronics I	3.00
2.	EEE 110	Simulation Lab	1.00
3.	CHEM 101	Chemistry	3.00
4.	CHEM 102	Chemistry Lab	1.00
5.	MATH 203	Linear Algebra and Matrices	3.00
6.	SOC 101	Society, Technology and Engineering Ethics	3.00
		Subtotal	14.00

Trimester 5

Sl. No.	Course Code	Course Title	Credit Hr.
1.	MATH 201	Coordinate geometry and vector analysis	3.00
2.	EEE 121	Structured Programming Language	3.00
3.	EEE 122	Structured Programming Language Lab	1.00
4.	EEE 207	Electronics II	3.00
5.	EEE 208	Electronics Lab	1.00
6.	MATH 157	Fourier and Laplace Transforms	3.00
		Subtotal	14.00

Trimester 6

Sl. No.	Course Code	Course Title	Credit Hr.
1.	EEE 215	Energy Conversion	3.00
2.	EEE 223	Digital Electronics	3.00
3.	EEE 224	Digital Electronics Lab	1.00
4.	EEE 211	Signals and Linear Systems	3.00
5.	MATH 153	Complex variables	3.00
		Subtotal	13.00

Trimester 7

Sl. No.	Course Code	Course Title	Credit Hr.
1.	EEE 255	Probability and Random Signal Analysis	3.00
2.	EEE 301	Electrical Properties of Materials	3.00
3.	EEE 313	Solid State Devices	3.00
4.	EEE 423	Microprocessor and Interfacing	3.00
5.	EEE 424	Microprocessor and Interfacing Lab	1.00
		Subtotal	13.00

Trimester 8

Sl. No.	Course Code	Course Title	Credit Hr.
1.	EEE 303	Engineering Electromagnetics	3.00
2.	EEE 309	Communication Theory	3.00
3.	EEE 310	Communication Laboratory	1.00
4.	EEE 311	Digital Signal Processing	3.00
5.	EEE 312	Digital Signal Processing Lab	1.00
6.	ECO 213	Economics	3.00
		Subtotal	14.00

Trimester 9

Sl. No.	Course Code	Course Title	Credit Hr.
1.	CSE 323	Computer Networks	3.00
2.	CSE 324	Computer Networks Lab	1.00
3.	EEE 455	Digital Communication	3.00
4.	EEE 456	Digital Communication Lab	1.00
5.	EEE 495	Information Theory and coding	3.00
		Subtotal	11.00

Trimester 10

Sl. No.	Course Code	Course Title	Credit Hr.
1.	EEE 400	Project and Thesis	1.50
2.	EEE 441	VLSI Design	3.00
3.	EEE 442	VLSI Design Lab	1.00
4.	EEE 459	Telecommunication Engineering	3.00

5.	IPE 401	Industrial Management	3.00
		Subtotal	11.50

Trimester 11

Sl. No.	Course Code	Course Title	Credit Hr.
1.	EEE 400	Project and Thesis	2.00
2.	EEE 433	Optoelectronics	3.00
3.	EEE 457	Mobile Cellular Communication	3.00
4.	EEE ***	Elective I	3.00
		Subtotal	11.00

Trimester 12

Sl. No.	Course Code	Course Title	Credit Hr.
1.	EEE 400	Project and Thesis	3.00
2.	EEE ***	Elective I	3.00
3.	EEE ***	Elective II	3.00
4.	EEE ***	Elective II Lab	1.00
5.			
		Subtotal	13.00

List of Elective Courses (EEE ***)

Elective courses are divided into two categories: Elective I and Elective II. Elective I courses are offered to build up the foundation on the specialized fields in Telecommunication Engineering. Elective II courses are offered with their companion laboratory courses so that the students get balanced education both on theory and practice. Two courses from Elective I and one from Elective II need to be taken.

Elective I

Sl. No.	Course Code	Course Title	Credit Hr.
1.	EEE 435	Analog Integrated Circuits	3.00
2.	EEE 445	VLSI design II	3.00
3.	EEE 461	Antenna and Propagation	3.00
4.	EEE 463	Satellite Communication	3.00
5.	EEE 465	Multimedia Communication	3.00
6.	EEE 469	Telecommunication Policy and Management	3.00
7.	EEE 493	Special Topics on Telecommunication Engineering	3.00
8.	EEE 491	Biomedical Engineering	3.00
9.	EEE 499	Introduction to Software Radios	3.00
10.	EEE 467	Advanced DSP and Filter Design	3.00
11.	EEE 453	Optical Fiber Communication	3.00
12.	EEE 467	Wireless Communication	3.00

Elective II

Sl. No.	Course Code	Course Title	Credit Hr.
1.	EEE 443	Power Electronics	3.00
2.	EEE 444	Power Electronics Lab	1.00
3.	EEE 447	Digital Integrated Circuits Design	3.00
4.	EEE 448	Digital Integrated Circuits Design Lab	1.00
5.	EEE 451	Microwave Engineering	3.00
6.	EEE 452	Microwave Engineering Lab	1.00
7.	EEE 497	RF Engineering	3.00
8.	EEE 498	RF Engineering Lab	1.00
9.	CSE 421	Microprocessor based System Design	3.00
10.	CSE 422	Microprocessor based System Design Lab	1.00

Credit hours distribution in twelve trimesters:

Trimester	Theory Credit	Lab. Credit	Total Credit
Trimester 1	6.0(+*6.0)	0.0	6.0 or 9.0
Trimester 2	12.0	1.0	13.0
Trimester 3	12.0	1.0	13.0 or 10.0
Trimester 4	12.0	2.0	14.0
Trimester 5	9.0	3.0	14.0
Trimester 6	12.0	0.0	13.0
Trimester 7	12.0	1.0	13.0
Trimester 8	9.0	2.0	11.0
Trimester 9	9.0	2.0	11.0
Trimester 10	9.0	2.5	11.5
Trimester 11	9.0	2.0	11.0
Trimester 12	9.0	4.0	13.0
Total	120.0	20.5	140.5

*Non-credit courses with total 6 contact hours

Course Contents

ETE 101 Electrical Circuits I

Circuit variables and elements: Voltage, current, power, energy, independent and dependent sources, resistance. Basic laws: Ohm's law, Kirchhoff's current and voltage laws. Simple resistive circuits: Series and parallel circuits, voltage and current division, Wye-Delta transformation. Techniques of circuit analysis: Nodal and mesh analysis including supernode and super mesh. Network theorems: Source transformation, Thevenin's, Norton's and Superposition theorems with applications in circuits having independent and dependent sources, maximum power transfer condition and reciprocity theorem. Energy storage elements: Inductors and capacitors, series parallel combination of inductors and capacitors. Responses of RL and RC circuits: Natural and step responses.

Magnetic quantities and variables: Flux, permeability and reluctance, magnetic field strength, magnetic potential, flux density, magnetization curve. Laws in magnetic circuits: Ohm's law and Ampere's circuital law. Magnetic circuits: series, parallel and series-parallel circuits.

ETE 103 Electrical Circuits II (Pre-requisite ETE 101)

Sinusoidal functions: Instantaneous current, voltage, power, effective current and voltage, average power, phasors and complex quantities, impedance, real and reactive power, power factor. Analysis of single phase ac circuits: Series and parallel RL, RC and RLC circuits, nodal and mesh analysis, application of network theorems in ac circuits, circuits simultaneously excited by sinusoidal sources of several frequencies, transient response of RL and RC circuits with sinusoidal excitation. Resonance in ac circuits: Series and parallel resonance. Magnetically coupled circuits. Analysis of three phase circuits: Three phase supply, balanced and unbalanced circuits, power calculation.

ETE 104 Electrical Circuits Laboratory

This course consists of two parts. In the first part, students will perform experiments to verify practically the theories and concepts learned in ETE 101 and ETE 103. In the second part, students will design simple systems using the principles learned in ETE 101 and ETE 103.

ETE 105 Electronics I (Pre-requisite ETE 103)

P-N junction as a circuit element: Intrinsic and extrinsic semiconductors, operational principle of p-n junction diode, current-voltage characteristics of a diode, simplified dc and ac diode models, dynamic resistance and capacitance. Diode circuits: Half wave and full wave bridge rectifiers, rectifiers with filter capacitor, characteristics of a zener diode and its applications. zener shunt regulator. Metal-Oxide-Semiconductor Field-Effect-Transistor (MOSFET) as circuit element: structure and physical operation of MOSFETs, body effect, current- voltage characteristics of MOSFETs, Early Effect, biasing discrete and integrated MOS amplifier circuits, single stage MOS amplifiers. Bipolar junction transistor (BJT) as a circuit element: Basic structure. BJT characteristics and regions of operation, DC analysis, biasing the BJT for discrete circuits, small signal equivalent circuit models, BJT as a switch. Single stage BJT amplifier circuits and their configurations: Voltage and current gain, input and output resistances. RC coupled two stage BJT amplifiers.

ETE 110 Simulation Laboratory (Prerequisite: ETE 105)
Simulation laboratory based on ETE 101, ETE 103 and ETE 105 theory courses. Students will verify the theories and concepts learned in ETE 101, ETE 103 and ETE 105 using simulation software like PSpice and Matlab. Students will also perform specific design of DC and AC circuits theoretically and by simulation. Students will learn how to write and debug programs for simulation of different mathematical models.

EEE 215 Energy Conversion (Pre-requisite ETE 103)
Electromechanical energy conversion fundamentals: Faraday's law of electromagnetic induction, Fleming's rule and Lenz's law. Elementary generator: Commutation, electromagnetic force, left hand rule, counter emf and comparison between generator and motor action. Transformer: Ideal transformer - transformation ratio, no-load and load vector diagrams; actual transformer - equivalent circuit, regulation, short circuit and open circuit tests. Three phase induction motor: Rotating magnetic field, equivalent circuit, vector diagram, torque-speed characteristics, effect of changing rotor resistance and reactance on torque-speed curves, motor torque and developed rotor power, no-load test, blocked rotor test, starting and braking and speed control. Single phase induction motor: Theory of operation, equivalent circuit and starting.

ETE 207 Electronics II (Pre-requisite ETE 105)
Operational amplifiers (Op-Amps): Properties of ideal Op-Amps, non inverting and inverting amplifiers, inverting integrators, differentiator, weighted summer and other applications of Op-Amp circuits, effects of finite open loop gain and bandwidth on circuit performance, slew rate.
Differential Amplifiers: Basic Differential pair, DC transfer characteristics, differential- and common-mode gains, frequency response of the cascade and differential amplifiers. Operational amplifiers (Op-Amp): logic signal operation of Op-Amp, dc imperfections. General purpose Op-Amp: DC analysis, small-signal analysis of different stages, gain and frequency response of 741 Op-Amp. Feedback: the general feedback structure, ideal closed-loop signal gain, gain sensitivity and noise sensitivity, some properties of negative feedback, the four basic feedback topologies, the series-shunt feedback amplifier, the series-series feedback amplifier, the shunt-shunt and shunt-series feedback amplifiers, Bode plots: one-, two and three-pole amplifiers,Nyquist Stability criterion. the effect of feedback on the amplifier poles. Active filters: Different types of filters and specifications, transfer functions, realization of first and second order low, high and band pass filters using OpAmps. Signal generators circuits: basic principle of sinusoidal oscillators, Op-Amp RC oscillators, the Wien-Bridge oscillator, LC and crystal oscillators. Output stages and power amplifiers: classification of output stages, class A, B and AB output stages.

ETE 208 Electronics Laboratory
This course consists of two parts. In the first part, students will perform experiments to verify practically the theories and concepts learned in ETE 201 and ETE 207. In the second part, students will design simple systems using the principles learned in ETE 201 and ETE 207.

ETE 211 Signals and linear systems (Prerequisite Math 157 and ETE 103)
Classification of signals, basic operation on signals, elementary signals, representation of signals using impulse function. Classification of systems, properties of Linear Time Invariant (LTI) system like linearity, causality, time invariance, memory, stability, invertibility. Time domain analysis of LTI systems, system representation, order of system, solution techniques,

impulse response, convolution. Basic concepts of state variable representation of a system. Frequency domain analysis of LTI systems, Fourier series and Fourier transforms and their properties, system transfer function. Laplace transforms and its properties, system transfer function, stability and frequency response, different techniques of inverse Laplace transforms.

ETE 255 Probability and Random Signal Analysis (Pre- or corequisite: ETE 211)
Probabilistic and statistical analysis as applied to electrical signals and systems. Statistics: Frequency distribution, Mean, Median, and other measures of central tendency. Standard deviation and other measures of dispersion. Moments, skenness and kurtosis. Probability and random variables. Distribution and density functions and conditional probability. Expectation: Moments and characteristic functions. Transformation of a random variable. Vector random variables. Joint distribution and density. Independence. Sums of random variables. Random Processes. Correlation functions. Process measurements. Gaussian and Poisson random processes. Noise models. Stationarity and Ergodicity. Spectral Estimation. Correlation and power spectrum. Cross spectral densities. Response of linear systems to random inputs. Introduction to discrete time processes, Mean-square error estimation, Detection and linear filtering.

ETE 301 Electrical Properties of Materials (Prerequisite PHY 103 and Math 153)
Crystal structures: Types of crystals, lattice and basis, Bravais lattice and Miller indices. Classical theory of electrical and thermal conduction: Scattering, mobility and resistivity, temperature dependence of metal resistivity, Mathiessen's rule, Hall effect and thermal conductivity. Introduction to quantum mechanics: Wave nature of electrons, Schrodinger's equation, one-dimensional quantum problems - infinite quantum well, potential step and potential barrier; Heisenberg's uncertainty principle and quantum box. Band theory of solids: Band theory from molecular orbital, Bloch theorem, Kronig-Penny model, effective mass, density-of-states. Carrier statistics: Maxwell-Boltzmann and Fermi-Dirac distributions, Fermi energy. Modern theory of metals: Determination of Fermi energy and average energy of electrons, classical and quantum mechanical calculation of specific heat. Dielectric properties of materials: Dielectric constant, polarization - electronic, ionic and orientational; internal field, Clausius-Mosotti equation, spontaneous polarization, frequency dependence of dielectric constant, dielectric loss and piezoelectricity. Magnetic properties of materials: Magnetic moment, magnetization and relative permittivity, different types of magnetic materials, origin of ferromagnetism and magnetic domains. Introduction to superconductivity: Zero resistance and Meissner effect, Type I and Type II superconductors and critical current density.

ETE 303 Engineering Electromagnetics (Prerequisite Math 201 and Phy 103)
Static electric field: Coulomb's law for discrete and continuously distributed charges, Gauss's law and its application, electrostatic potential, conductors and dielectrics in static electric field, flux density - boundary conditions; capacitance - electrostatic energy and forces, capacitance calculation of different geometries; boundary value problems - Poisson's and Laplace's equations. Steady electric current: Ohm's law, continuity equation, Joule's law, resistance calculation. Static Magnetic field: Postulates of magnetostatics, Biot-Savart's law, Ampere's law, vector magnetic potential, magnetic dipole, magnetic field intensity and relative permeability, boundary conditions for magnetic field, magnetic energy, magnetic forces, torque and inductance of different geometries. Time varying fields and Maxwell's equations: Faraday's law of electromagnetic induction, Maxwell's equations - differential and

integral forms, boundary conditions, potential functions; and Poynting theorem. Plane electromagnetic wave: plane wave in loss less media - Doppler effect, transverse electromagnetic wave, polarization of plane wave; plane wave in lossy media - low-loss dielectrics, good conductors; group velocity, instantaneous and average power densities, normal and oblique incidence of plane waves at plane boundaries for different polarization.

ETE 309 Communication Theory (Prerequisite ETE 211and ETE 255)
Overview of communication systems: fundamental elements, system limitations, message source, bandwidth requirements, transmission media types, bandwidth and transmission capacity. Noise: Source, characteristics of various types of noise and signal to noise ratio. Information theory: Measure of information, source encoding, error free communication over a noisy channel, channel capacity of a continuous system and channel capacity of a discrete memory less system. Communication systems: Analog and digital. Continuous wave modulation: Transmission types - base-band transmission, carrier transmission; amplitude modulation - introduction, double side band, single side band, vestigial side band, quadrature; spectral analysis of each type, envelope and synchronous detection; angle modulation instantaneous frequency, frequency modulation (FM) and phase modulation (PM), spectral analysis, demodulation of FM and PM. Pulse modulation: Sampling - sampling theorem, Nyquist criterion, aliasing, instantaneous and natural sampling; pulse amplitude modulation - principle, bandwidth requirements; pulse code modulation (PCM) - quantization principle, quantization noise, differential PCM, demodulation of PCM; delta modulation (DM) - principle, adaptive DM; line coding - formats and bandwidths. Digital modulation: Amplitude-shift keying - principle, ON-OFF keying, bandwidth requirements, detection, noise performance; phase-shift keying (PSK) - principle, bandwidth requirements, detection, differential PSK, quadrature PSK, noise performance; frequency-shift Keying (FSK) - principle, continuous and discontinuous phase FSK, minimum-shift keying, bandwidth requirements, detection of FSK. Multiplexing: Time- division multiplexing (TDM) - principle, receiver synchronization, frame synchronization, TDM of multiple bit rate systems; frequency-division multiplexing - principle, de-multiplexing; wavelength-division multiplexing, multiple-access network - time-division multiple-access, frequency-division multiple access; code-division multiple- access (CDMA) - spread spectrum multiplexing, coding techniques and constraints of CDMA. Communication system design: design parameters, channel selection criteria and performance simulation.

ETE 310 Communication Laboratory
This course consists of two parts. In the first part, students will perform experiments to verify practically the theories and concepts learned in ETE 309. In the second part, students will design simple systems using the principles learned in ETE 309.

ETE 311 Digital Signal Processing (Pre-requisite ETE 211)
Introduction to digital signal processing (DSP): Discrete-time signals and systems, analog to digital conversion, impulse response, finite impulse response (FIR) and infinite impulse response (IIR) of discrete-time systems, difference equation, convolution, transient and steady state response. Discrete transformations: Discrete Fourier series, discrete-time Fourier series, discrete Fourier transform (DFT) and properties, fast Fourier transform (FFT), inverse fast Fourier transform, Z transformation - properties, transfer function, poles and zeros and inverse Z transform. Correlation: circular convolution, auto-correlation and cross correlation. Digital Filters: FIR filters - linear phase filters, specifications, design using window, optimal and frequency sampling methods; IIR filters - specifications, design using impulse invariant, bi-linear Z transformation, least-square methods and finite precision effects.

ETE 312 Digital Signal Processing Laboratory
This course consists of two parts. In the first part, students will perform experiments to verify practically the theories and concepts learned in ETE 311. In the second part, students will design simple systems using the principles learned in ETE 311.

ETE 313 Solid State Devices (Prerequisite ETE 301)
Semiconductors in equilibrium: Energy bands, intrinsic and extrinsic semiconductors, Fermi levels, electron and hole concentrations, temperature dependence of carrier concentrations and invariance of Fermi level. Carrier transport processes and excess carriers: Drift and diffusion, generation and recombination of excess carriers, built-in-field, Einstein relations, continuity and diffusion equations for holes and electrons and quasi-Fermi level. PN junction: Basic structure, equilibrium conditions, contact potential, equilibrium Fermi level, space charge, non-equilibrium condition, forward and reverse bias, carrier injection, minority and majority carrier currents, transient and ac conditions, time variation of stored charge, reverse recovery transient and capacitance. Bipolar junction transistor: Basic principle of pnp and npn transistors, emitter efficiency, base transport factor and current gain, diffusion equation in the base, terminal currents, coupled-diode model and charge control analysis, Ebers-Moll equations and circuit synthesis. Metal-semiconductor junction: Energy band diagram of metal semiconductor junctions, rectifying and ohmic contacts. MOS structure: MOS capacitor, energy band diagrams and flat band voltage, threshold voltage and control of threshold voltage, static C-V characteristics, qualitative theory of MOSFET operation, body effect and current-voltage relationship of a MOSFET. Junction Field-effect-transistor: Introduction, qualitative theory of operation, pinch-off voltage and current-voltage relationship.

ETE 400 Project
A final year project based on Electrical Engineering or Computer Engineering Problems.

ETE 433 Optoelectronics (Prerequisite ETE 207 and ETE 313)
Optical properties in semiconductor: Direct and indirect band-gap materials, radiative and non-radiative recombination, optical absorption, photo-generated excess carriers, minority carrier life time, luminescence and quantum efficiency in radiation. Properties of light: Particle and wave nature of light, polarization, interference, diffraction and blackbody radiation. Light emitting diode (LED): Principles, materials for visible and infrared LED, internal and external efficiency, loss mechanism, structure and coupling to optical fibers. Stimulated emission and light amplification: Spontaneous and stimulated emission, Einstein relations, population inversion, absorption of radiation, optical feedback and threshold conditions. Semiconductor Lasers: Population inversion in degenerate semiconductors, laser cavity, operating wavelength, threshold current density, power output, optical and electrical confinement. Introduction to quantum well lasers. Photo-detectors: Photoconductors, junction photo-detectors, PIN detectors, avalanche photodiodes and phototransistors. Solar cells: Solar energy and spectrum, silicon and schottky solar cells. Modulation of light: Phase and amplitude modulation, electro-optic effect, acousto-optic effect and magento-optic devices. Introduction to integrated optics.

ETE 435 Analog Integrated Circuits (Prerequisite ETE 207)
Review of FET amplifiers: Passive and active loads and frequency limitation. Current mirror: Basic, cascade and active current mirror. Differential Amplifier: Introduction, large and small signal analysis, common mode analysis and differential amplifier with active load Noise:

Introduction to noise, types, representation in circuits, noise in single stage and differential amplifiers and bandwidth. Band-gap references: Supply voltage independent biasing, temperature independent biasing, proportional to absolute temperature current generation and constant transconductance biasing. Switch capacitor circuits: Sampling switches, switched capacitor circuits including unity gain buffer, amplifier and integrator. Phase Locked Loop (PLL): Introduction, basic PLL and charge pumped PLL.

ETE 437 Semiconductor Device Theory (Prerequisite ETE 313)
Lattice vibration: Simple harmonic model, dispersion relation, acoustic and optical phonons. Band structure: Isotropic and anisotropic crystals, band diagrams and effective masses of different semiconductors and alloys. Scattering theory: Review of classical theory, Fermi-Golden rule, scattering rates of different processes, scattering mechanisms in different semiconductors, mobility. Different carrier transport models: Drift-diffusion theory, ambipolar transport, hydrodynamic model, Boltzmann transport equations, quantum mechanical model, simple applications.

ETE 441 VLSI Design (Prerequisite ETE 207 and CSE 223)
VLSI technology: Top down design approach, technology trends and design styles. Review of MOS transistor theory: Threshold voltage, body effect, I-V equations and characteristics, latch-up problems, NMOS inverter, CMOS inverter, pass-transistor and transmission gates. CMOS circuit characteristics and performance estimation: Resistance, capacitance, rise and fall times, delay, gate transistor sizing and power consumption. CMOS circuit and logic design: Layout design rules and physical design of simple logic gates. CMOS subsystem design: Adders, multiplier and memory system, arithmetic logic unit. Programmable logic arrays. I/O systems. VLSI testing.

ETE 442 VLSI Design Laboratory
This course consists of two parts. In the first part, students will perform experiments to verify practically the theories and concepts learned in ETE 441. In the second part, students will design simple systems using the principles learned in ETE 441.

ETE 443 Power Electronics (Prerequisite ETE 207)
Power semiconductor switches and triggering devices: BJT, MOSFET, SCR, IGBT, GTO, TRIAC, UJT and DIAC. Rectifiers: Uncontrolled and controlled single phase and three phase. Regulated power supplies: Linear-series and shunt, switching buck, buck boost, boost and Cuk regulators. AC voltage controllers: single and three phase. Choppers. DC motor control. Single phase cycloconverter. Inverters: Single phase and three phase voltage and current source. AC motor control. Stepper motor control. Resonance inverters. Pulse width modulation control of static converters.

ETE 444 Power Electronics Laboratory
This course consists of two parts. In the first part, students will perform experiments to verify practically the theories and concepts learned in ETE 443. In the second part, students will design simple systems using the principles learned in ETE 443.

ETE 445 VLSI Design II (Prerequisite ETE 441)
VLSI MOS system design: Layout extraction and verification, full and semi-full custom design styles, logical and physical positioning. Design entry tools: schematic capture and HDL. Logic and switch level simulation. Static timing, concepts and tools of analysis,

solution techniques for floor planning, placement, global routing and detailed routing. Application specific integrated circuit design including FPGA.

ETE 447 Digital Integrated Circuits Design (Prerequisite ETE 207 & CSE 223)
Switching, timing, wave shaping, and logic circuits to generate waveforms and functions used in pulse systems, instrumentation and computers. Latches, Flip-Flops and Synchronous System Design. Advanced CMOS Logic Design: Pseudo-NMOS and Dynamic Precharging, Domino-CMOS logic, No-Race-Logic, Single-Phase Dynamic Logic, Dynamic Differential Logic. Digital Integrated System Building Blocks: Multiplexers and Decoders, Barrel shifters, counters, digital adders, PLA. Integrated memories: SRAM, DRAM, ROM.

ETE 448 Digital Integrated Circuits Design Laboratory
This course consists of two parts. In the first part, students will perform experiments to verify practically the theories and concepts learned in ETE 447. In the second part, students will design simple systems using the principles learned in ETE 447.

ETE 451 Microwave Engineering (Pre-requisite ETE 303)
Transmission lines: Voltage and current in ideal transmission lines, reflection, transmission, standing wave, impedance transformation, Smith chart, impedance matching and lossy transmission lines. Waveguides: general formulation, modes of propagation and losses in parallel plate, rectangular and circular waveguides. Micro strips: Structures and characteristics. Rectangular resonant cavities: Energy storage, losses and Q. Radiation: Small current element, radiation resistance, radiation pattern and properties, Hertzian and halfwave dipoles. Antennas: Mono pole, horn, rhombic and parabolic reflector, array, and Yagi-Uda antenna.

ETE 452 Microwave Engineering Laboratory
This course consists of two parts. In the first part, students will perform experiments to verify practically the theories and concepts learned in ETE 451. In the second part, students will design simple systems using the principles learned in ETE 451.

ETE 453 Optical Fiber Communication (Prerequisite ETE 303 and ETE 313)
Introduction. Light propagation through optical fiber: Ray optics theory and mode theory. Optical fiber: Types and characteristics, transmission characteristics, fiber joints and fiber couplers. Light sources: Light emitting diodes and laser diodes. Detectors: PIN photo-detector and avalanche photo-detectors. Receiver analysis: Direct detection and coherent detection, noise and limitations. Transmission limitations: Chromatic dispersion, nonlinear refraction, four wave mixing and laser phase noises. Optical amplifier: Laser and fiber amplifiers, applications and limitations. Multi-channel optical system: Frequency division multiplexing, wavelength division multiplexing and co-channel interference.

ETE 454 Optical Fiber Communication Laboratory
This course consists of two parts. In the first part, students will perform experiments to verify practically the theories and concepts learned in ETE 453. In the second part, students will design simple systems using the principles learned in ETE 453.

ETE 455 Digital Communication (Prerequisite ETE 309)
Introduction: Communication channels, mathematical model and characteristics. Probability and stochastic processes. Source coding: Mathematical models of information, entropy Huffman code and linear predictive coding. Digital transmission system: Base band digital

transmission, inter-symbol interference, bandwidth, power efficiency, modulation and coding trade-off. Receiver for AWGN channels: Correlation demodulator, matched filter demodulator and maximum likelihood receiver. Channel capacity and coding: Channel models and capacities and random selection of codes. Block codes and conventional codes: Linear block codes, convolution codes and coded modulation. Spread spectrum signals and system.

ETE 456 Digital Communication Laboratory

This course consists of two parts. In the first part, students will perform experiments to verify practically the theories and concepts learned in ETE 455. In the second part, students will design simple systems using the principles learned in ETE 455.

ETE 457 Mobile Cellular Communication (Prerequisite ETE 309)

Introduction: Concept, evolution and fundamentals. Analog and digital .cellular systems. Cellular Radio System: Frequency reuse, co-channel interference, cell splitting and components. Mobile radio propagation: Propagation characteristics, models for radio propagation, antenna at cell site and mobile antenna. Frequency Management and Channel Assignment: Fundamentals, spectrum utilization, fundamentals of channel assignment, fixed channel assignment, non-fixed channel assignment, traffic and channel assignment. Handoffs and Dropped Calls: Reasons and types, forced handoffs, mobile assisted handoffs and dropped call rate. Diversity Techniques: Concept of diversity branch and signal paths, carrier to noise and carrier to interference ratio performance. Digital cellular systems: Global system for mobile, time division multiple access and code division multiple access.

ETE 459 Telecommunication Engineering (Prerequisite ETE 309)

Introduction: Principle, evolution, 'networks, exchange and international regulatory bodies. Telephone apparatus: Microphone, speakers, ringer, pulse and tone dialing mechanism, side-tone mechanism, local and central batteries and advanced features. Switching system: Introduction to analog system, digital switching systems - space division switching, blocking probability and multistage switching, time division switching and two dimensional switching. Traffic analysis: Traffic characterization, grades of service, network blocking probabilities, delay system and queuing. Modem telephone services and network: Internet telephony, facsimile, integrated services digital network, asynchronous transfer mode and intelligent networks. Introduction to cellular telephony and satellite communication.

ETE 461 Antenna and Propagation (Prerequisite ETE 303)

Basics of antenna: gain and effective area; radiation pattern, gain and radiation impedance of monopole, dipole, folded dipole, array of isotropic radiators; Antenna as an aperture: Babinet's principle, horn and reflector type of antenna. Printed antennas. Propagation of radio waves – broadcast and line of sight, transmission and reception of radio waves, effect of earth's curvature; long, medium and short wave propagation, ionospheric propagation, scattering in radio links, effect of rain and dust.

ETE 463 Satellite communication (Prerequisite ETE 303 and ETE 309)

Brief history and overview of satellite communications, communication satellite systems, communication satellites, orbiting satellites, satellite frequency bands, satellite multi-access formats, the Regulatory Bodies. Frequency allocations. Fundamental orbital laws, GEO, MEO, LEO satellites, subsystems of a communication satellite, earth station, satellite link analysis, attenuation, effect of rain on propagation. Modulation and multiplexing techniques for satellite link, Communication payload, transponders, coverage. Multiple access techniques: FDMA, SPADE, TDMA, CDMA, Antijam advantage of spectral spreading, satellite jamming, DS-CDMA acquisition and tracking, FH-CDMA acquisition and tracking, random access. Phase coherency in satellite systems: carrier phase-noise, phase noise spectra, carrier frequency and phase stability, phase errors in carrier referencing. Satellite ranging systems: ranging systems, component-ranging codes, and tone-ranging systems. Inter-satellite links, VSAT satellite system concept, link analysis, mobile-satellite communication systems, mobile satellite channel, direct home TV broadcasting.

ETE 465 Multimedia Communication (Prerequisite ETE 309 and ETE 311)
Some basics on television systems, multidimensional signals and Fourier transform, multidimensional (space-time) sampling, interlaced and non-interlaced scanning: Information theory: conditional and joint entropy and redundancy, source coding theorem, statistical source models, mutual information rate distortion theory: Predictive coding: linear prediction, quantization, optimum predictor; Discrete two-dimensional transforms: DFT, DCT,. wavelet and Hadamard transforms; Transform Coding with motion estimation, principles of MPEG coding; Modern audiovisual terminals and communication systems.

ETE 467 Wireless Communication (Prerequisite ETE 303 and ETE 309)
Basics of Antenna; gain and effective area, radiation pattern. Propagation of radio waves – broadcast and line of sight, transmission and reception of radio waves, effect of earth's curvature; long, medium and short wave propagation, ionospheric propagation. RADAR and its principle; communication systems for ships and aircrafts. Scattering in radio links. Overview of satellite communication; location of geo-stationary satellites and orbit calculation. Lasers and optical detectors; line of sight laser communication.

ETE 469 Telecommunication Policy and Management (Prerequisite ETE 309)
International telecommunication organizations, trans-border data flow, barriers to trade in information equipment and services, development of competition, and World Trade Organization telecommunication agreement. Policy problems created by the vulnerability of telecommunication and computer networks to accidental or intentional attacks, dependence of economic and military security on telecommunication networks, information warfare, privacy and surveillance, international trade and information security. Fundamentals of daily telecommunication operations, including human factors in organization, acquisition and procurement, research and development, logistical planning, and relations with carriers and manufacturers.

ETE 493 Special Topics on Telecommunication Engineering (Prerequisite ETE 309)
This course is aimed at covering topics of current interest and new technology of Telecommunication Engineering

ETE 495 Information Theory and coding (Prerequisite ETE 309 and ETE 255)
Basic concepts of information theory and its measurement, error coding in communication systems. Entropy, zero-memory information source, Markov information source. Adjoin source, language structure. Huffman codes, LZ, arithmetic codes. Introduction to rate distortion theory. Channel coding theorem, channel capacity, Shannon limit. Block codes: characteristics of block codes, non-singular block codes, uniquely decodable codes, instantaneous codes, Kraft's inequality. Error detection, Burst error detecting and correcting codes, linear block codes, binary cyclic codes, Hamming codes, BCH codes, and Read-

Solomon codes, encoding, Syndrome decoding and decoding algorithms. Introduction to convolution codes, code tree, trellis, state diagram, maximum likelihood decoding and the Viterbi algorithm. Trellis-coded modulation and Ungerboeck codes. Introduction to Turbo coding. Selection of coding scheme.

ETE 497 RF Communications and Engineering (Prerequisite ETE 309 and ETE 255)
Introduction to Wireless Components: Antenna, Amplifier, Mixer, Oscillator,
Resonant Circuits.
Noise: Thermal Noise, Shot Noise, Noise Voltage and Power, Mixing of Noise
Noise Temperature and Noise Figure (NF), NF of Cascaded Components, NF of passive networks.
Effects of Nonlinearity: Harmonics, Sensitivity and Dynamic Range, Gain Compression (P1dB), Intermodulation Distortion, Third Order Intercept Point (IP3), IP2, Intercept points of cascaded components.
Impedance matching: Smith chart, L-Network, Pi Network Impedance matching. Impedance matching using smith chart.
Filter: Filter Design: Maximally Flat, Equal ripple, Linear Phase Filter, Filter Scaling and Transformation. Butterworth, Chebyshev response.
Amplifiers and Oscillators: S-Parameter, Power Gain, Stability, Stability Circles, Low Noise Amplifier (**LNA**) design, Characteristics of Power Amplifier (**PA**) and amplifier classes.
Oscillator Tuning Range, Frequency Stability, Voltage Controlled Oscillator (VCO),
Oscillator Phase Noise. Amplifier and Oscillator Design using S-parameters.2
Mixer: Frequency Conversion, Image Frequency, Conversion Loss, Isolation, Diode Mixer, Image Reject Mixer.

ETE 498 RF Communications and Engineering Laboratory
This course consists of two parts. In the first part, students will perform experiments to verify practically the theories and concepts learned in ETE 497. In the second part, students will design simple systems using the principles learned in ETE 497.

EEE 121 Structured Programming Language
Overview, Structure of C program, Data Types and Data Type Qualifier, I/O Functions-Character I/O, Formatted I/O, Character Set, Identifiers, Keywords and Contents, Variables, Expressions, Statement and Symbolic Constants, Arithmetic operators, Relational Operators and Logical Operators, Assignment Operators, Increment/Decrement Operators, Unary Operator and Conditional Operator., Bit-wise Operators, Comma Operator, Precedence and Associativity, Branching: The IF statement (break and continue statement), Branching: SWITCH statement, GOTO statement and operator, Looping: FOR statement (break and continue), Looping: WHILE and DO WHILE statement, Storage class: Automatic, Static, Register and Extern, Functions: Access, Prototype, Argument Passing and Value Receiving, Functions: Pass-by-value, Pass-by-reference and Value Receiving , Functions: Command Line Parameter and Library Functions, Arrays: Initialization, Access, Passing and Receiving , Arrays: 2D handling, Arrays: Sorting and Searching , String Handling , Structure: Initialization, Access, Passing and Receiving, Structure: Embedded Structure, Union and Bit-fields, File: Types of File, Text File Handling, File: Binary File Handling , File: Data File Management Program, Pointer: Concept, Passing and Receiving, Memory Allocation and Release, Pointer: List or Tree Management by Self-Referential Structure, Pointer: Pointer and Multi-Dimensional Arrays, Enumeration, Macros, Pre-Processor and Compiler , Directives,

Library, Compiler and Linker, Segment and Memory Model, Video Adapter, Modes and Graphics Initialization, Graphics Functions

EEE 122 Structured Programming Language Sessional
Laboratory work based on **EEE 121**

EEE 223 Digital Electronics (Prerequisite ETE 105)
Number systems and codes: number system, arithmetic, base conversion, signed number representation and computer codes. Analysis and synthesis of logic circuits: Boolean algebra, switching functions, switching circuits and combinational logic circuits. Implementation of basic static logic gates in CMOS and BiCMOS: DC characteristics, noise margin and power dissipation. Power optimization of basic gates and combinational logic circuits. Modular combinational circuit design: pass transistor, pass gates, multiplexer, demultiplexer and their implementation in CMOS, decoder, encoder, comparators, binary arithmetic elements and ALU design. Programmable logic devices: logic arrays, field programmable logic arrays and programmable read only memory. Sequential circuits: different types of latches, flip-flops and their design using ASM approach, timing analysis and power optimization of sequential circuits. Modular sequential logic circuit design: shift registers, counters and their applications.

EEE 224 Digital Electronics Laboratory
This course consists of two parts. In the first part, students will perform experiments to verify practically the theories and concepts learned in EEE 223. In the second part, students will design simple systems using the principles learned in EEE 223

CSE 323 Computer Networks (Prerequisite ETE 309)
Network architectures- layered architectures and ISO reference model: data link protocols, error control, HDLC, X.25, flow and congestion control, virtual terminal protocol, data security, Local area networks, satellite networks, packet radio networks, Introduction to ARPANET, SNA and DECNET, Topological design and queuing models for network and distributed computing systems.

CSE 324 Computer Networks Sessional
Laboratory work based on **CSE 323**

CSE 421 Microprocessor System Design (Prerequisite CSE 423)
Limitations of 16 bit processors. 32 bit microprocessors (Intel 80386/80486, Motorola 68000) internal architecture, addressing modes, instructions, memory and I/O interfaces, system design, programming, applications to industrial process control. Embedded processors architecture, advanced port, programming, controller design for adjustable speed motor devices.

CSE 422 Microprocessor System Design Laboratory
This course consists of two parts. In the first part, students will perform experiments to verify practically the theories and concepts learned in CSE 421. In the second part, students will design simple systems using the principles learned in CSE 421.

EEE 423 Microprocessor and Interfacing (Prerequisite EEE 121 and CSE 223)
Introduction to microprocessors. Intel 8086 microprocessor: Architecture, addressing modes, instruction sets, assembly language programming, system design and interrupt. Interfacing: programmable peripheral interface, programmable timer, serial communication interface,

programmable interrupt controller, direct memory access, keyboard and display interface. Introduction to micro-controllers.

EEE 424 Microprocessor and Interfacing Laboratory
This course consists of two parts. In the first part, students will perform experiments to verify practically the theories and concepts learned in EEE 423. In the second part, students will design simple systems using the principles learned in EEE 423.

Chem 101 Chemistry
Atomic structure, quantum numbers, electronic configuration, periodic table; Properties and uses of noble gases; Different types of chemical bonds and their properties; Molecular structure of compounds; Selective organic reactions; Different types of solutions and their compositions; Phase rule, phase diagram of mono component system; Properties of dilute solutions; Thermochemistry, chemical kinetics, chemical equilibria; Ionization of water and pH concept; Electrical properties of Solution.

Chem 102 Chemistry Laboratory
Experiments based on Chem 101

Phy 101: Physics I
Physical Optics: Theories of light: Interference of light, Young's double slit experiment, Displacements of fringes & its uses. Fressnel Bi-prism, Interference at wedge shaped films, Newton's rings, Interferometers; Diffraction of light: Fresnel and Fraunhoffer diffraction. Diffraction by single slit. Diffraction from a circular aperture, Resolving power of optical instruments, Diffraction at double slit & N-slits-diffraction grating; Polarization: Production & analysis of polarized light, Brewster's law, Malus law, Polarization by double refraction. Retardation plates. Nicol prism. Optical activity. Polarimeters, Polaroid.
Waves & Oscillations: Differential equation of a Simple Harmonic Oscillator, Total energy & average energy, Combination of simple harmonic oscillation, Lissajous figures, Spring-mass system, Calculation of time period of torsional pendulum, Damped oscillation, Determination of damping co-efficient. Forced oscillation. Resonance, Two-body oscillation. Reduced mass Differential equation of a progressive wave, Power & intensity of wave motion, Stationary wave, Group velocity & Phase velocity. Architectural acoustics, Reverberation and Sabine's formula.
Modern Physics: Michelson-Morley's experiment. Galilean transformation, Special theory of relativity & its consequences; Quantum theory of Radiation: Photo-electric effect, Compton effect, wave particle duality. Interpretation of Bohr's postulates, Radioactive disintegration, Properties of nucleus, Nuclear reactions, Fission. Fusion, Chain reaction, Nuclear reactor.

Phy 103: Physics II (Prerequisite Phy 101)
Heat & thermodynamics: Principle of temperature measurements: Platinum resistance thermometer, Thermo-electric thermometer, Pyrometer; Kinetic theory of gases: Maxwell's distribution of molecular speeds, Mean free path, Equipartition of energy, Brownian motion, van der Waal's equation of state, Review of the First law of thermodynamics and its application, Reversible & irreversible processes, Second law of thermodynamics, Carnot; Efficiency of heat engines, Carnot theorem, Entropy and Disorder, Thermodynamic Functions, Maxwell relations, Clausius-Clapeyron equation, Gibbs phase rule, Third law of thermodynamics.

Properties of Matter: States of matter; Elastic properties of solids: Coefficients of elasticity, Energy calculation; Flow of liquids: Equation of continuity, Laminar and turbulent flow, Reynolds number & its significance, Bernoullis theorem and its application; Viscosity: poiseulles equation, Motion in a viscous medium, Determination of coefficient of viscosity; Surface tension: Surface tension as a molecular phenomenon, Surface tension and surface energy, Capillarity and angle of contact, Quincke's method.

Phy 104 Physics Laboratory
Experiments based on Phy 103

Math 003 Elementary Calculus
(non-credit course)
Number System: Natural Number, Integer, Rational Number, Irrational Number, Real Number, Even and Odd Number, Prime Number, Interval, Inequality; **Functions:** One-to-one, Many-to-one Function, Domain, Range, Inverse Function, Even and Odd Function; **Graphs:** Algebraic (Quadratic, Cubic) and Transcendental (Trigonometric, Exponential, Logarithmic) Function, Absolute Value Function; **Graphing New Functions from Old:** Translations, Reflections, Stretches and Compressions; **Differentiation:** Limit, Continuity and Derivative of Functions; **Integration:** Indefinite Integral, Integration by substitution. Definite integral. Area under curves.

Math 151 Differential and Integral Calculus I
Differential Calculus: Limits, Continuity and differentiability. Successive differentiation of various types of functions. Leibnitz's theorem. Roller's theorem. Mean value theorem. Taylor's and Maclaurin's theorems in finite and infinite forms. Lagrange's form of remainders. Cauchy's form of remainders. Expansion of functions by differentiation and integration. Evaluation of indeterminate forms by L'Hospitals rule. Partial differentiation. Euler's theorem. Tangent and Normal. Subtangent and subnormal in cartesian and polar co-ordinates. Determination of Maximum and minimum values of functions and points of inflection with applications. Curvature: radius, circle, centre and chord of curvature, asymptotes and curved tracing.
Integral Calculus : Integration by the method of substitution. Standard integrals. Integration by successive reduction. Definite integrals, its properties and use in summing series. Walli's formulate. Improper integrals. Beta function and Gamma function. Area under a plane curve and area of a region enclosed by two curves in cartesian and polar co-ordinate. Volumes of solids of revolution. Volume of hollow solids of revolution by shell method Area of surface of revolution. Jacobians. Multiple integrals with applications.

Math 153 Complex Variables I (Prerequisite Math 201)
Complex Variable: Complex number system. General functions of a complex variable. Limits and continuity of a function of a complex variable and related theorems. Complex differentiation and the Cauchy-Riemann equations. Infinite series. Convergence and uniform convergence. Line integral of a complex function Cauchy integral formula. Liouville's theorem. Taylor's and Laurent's theorem. Singular points. Residue, Cauchy's residue theorem.

Math 155 Ordinary and Partial Differential Equations I (Prerequisite Math 151)
Ordinary Differential Equations: Degree and order of ordinary differential equations. Formation of differential equations. Solutions of first order differential equations by various

methods. Solutions of general linear equations of second and higher orders with constant coefficients.
Solution of homogeneous linear equations. Solution of differential equation of the higher order when the dependent or independent variable is absent. Solution of differential equation by the method based on the factorization of the operators. Frobenius method.

Partial differential equations: Wave equations. Particular solutions with boundary and initial conditions.

Math 157 Fourier and Laplace Transformations (Prerequisite Math 155)
Laplace Transforms: Definition. Laplace transforms of some elementary functions. Sufficient conditions for existence of Laplace transforms. Inverse Laplace transforms. Laplace transforms of derivatives. The unit step function. Periodic function. Some special theorems on Laplace transforms. Partial fraction. Solution of differential equations by Laplace transforms. Evaluation of improper integrals.
Fourier Analysis: Real and complex forms of Fourier series. Finite transform. Fourier integral. Fourier transforms and their uses in solving boundary value problems.

Math 201 Co-ordinate Geometry and Vector Analysis I
Two-dimensional co-ordinate Geometry: Change of axes-transformation of co-ordinates, simplification of equations of curves.
Three-dimensional co-ordinate Geometry: System of co-ordinates, distance between two points, section formula, projection, direction cosines, equations of planes and lines.
Vector Analysis: Definition of vectors. Equality, addition and multiplication of vectors. Linear dependence and independence of vectors. Differentiation and integration of vectors together with elementary applications. Definitions of line, surface and volume integrals. Gradient of a scalar function, divergence and curl of a vector function. Physical significance of gradient, divergence and curls. Various formulae. Integral forms of gradient, divergence and curl. Divergence theorem. Stoke's theorem, Green's theorem and Gauss's theorem.

Math 203 Linear Algebra and Matrices I (Prerequisite Math 155)
Matrices: Definition, equality, addition, subtraction multiplication, transposition, inversion, rank. Equivalence, solution of equations by matrix method. Vector space, Eigen values and Eigen vectors. Bassel's and Legendre's differential equations.

Math 205 Probability and Statistics I
Statistics: frequency distribution. Mean, median, mode and other measures of central tendency. Standard deviation and other measures of dispersion. Moments, skewness and kurtosis. Elementary probability theory and discontinuous probability distribution, e.g., binomial, Poisson and negative binomial. Continuous probability distributions, e.g. normal and exponential. Characteristics of distributions. Elementary sampling theory. Estimation. Hypothesis testing and regression analysis. Time series analysis and Markov chain.

ECO 213 Economics
Definition of Economics; Economics and engineering; Principles of economics

Micro-Economics: Introduction to various economic systems – capitalist, command and mixed economy; Fundamental economic problems and the mechanism through which these problems are solved; Theory of demand and supply and their elasticities; Theory of consumer behavior; Cardinal and ordinal approaches of utility analysis; Price determination; Nature of an economic theory; Applicability of economic theories to the problems of developing countries; Indifference curve techniques; Theory of production, production function, types of productivity; Rational region of production of an engineering firm; Concepts of market and market structure; Cost analysis and cost function; Small scale production and large scale production; Optimization; Theory of distribution; Use of derivative in economics: maximization and minimization of economic functions, relationship among total, marginal and average concepts.
Macro-economics: Savings; investment, employment; national income analysis; Inflation; Monetary policy; Fiscal policy and trade policy with reference to Bangladesh; Economics of development and planning.

ENG 101 English I
The course aims at developing proficiency in speaking, listening, reading, and writing of English. It is generalized as a remedial course for students whose English need considerable repair and as a foundation courses for ENG 103. The contents include parts of speech, count and uncountable nouns and articles, agreement between subject and verb, adverbs of frequency, tense and the sequence of tenses, active and passive voices, types of sentences, prepositions: time, place, action, directions, questions forms, multi-word verbs, capitalization.

ENG 103 English II (Prerequisite ENG 101)
A course to provide solid foundation on study skills in English reading writing, listening comprehension and speaking. The course emphasizes the practice of pronunciation, speed-reading, and effective writing and listening. The course contents include the grammar parts of revision of tenses, use of idioms, prepositions, modals, conditional sentence, use of linking words, use of suffixes and prefixes, synonyms and antonyms, words with multi names, reading parts include the skills in skimming, scanning, selecting information, writing parts include planning, outlining, organizing ideas, topic sentences, paragraph writing, essay writing, job applications, writing reports, writing research report.

ACT 111 Financial and Managerial Accounting
Financial Accounting: Objectives and importance of accounting; Accounting as an information system; Computerized system and applications in accounting. Recording system: double entry mechanism; accounts and their classification; Accounting equation; Accounting cycle: journal, ledger, trial balance; Preparation of financial statements considering adjusting and closing entries; Accounting concepts (principles) and conventions.
Financial statement analysis and interpretation: ratio analysis.
Cost and Management Accounting: Cost concepts and classification; Overhead cost: meaning and classification; Distribution of overhead cost; Overhead recovery method/rate; Job order costing: preparation of job cost sheet and quotation price; Inventory valuation: absorption costing and marginal/variable costing techniques; Cost-Volume-Profit analysis: meaning breakeven analysis, contribution margin approach, sensitivity analysis.
Short-term investment decisions: relevant and differential cost analysis. Long-term investment decisions: capital budgeting, various techniques of evaluation of capital investments.

IPE 401 Industrial Management

Introduction, evolution, management function, organization and environment.

Organization: Theory and structure; Coordination; Span of control; Authority delegation; Groups; Committee and task force; Manpower planning.

Personnel 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.

Marketing Management: Concepts; Strategy; Sales promotion; Patent laws.

Technology Management: Management of innovation and changes; Technology life cycle; Case studies.

SOC 101 Society, Technology and Engineering Ethics

Engineering Ethics will consider ethical issues in the practice of engineering: safety and liability, professional responsibility to clients and employers, whistle-blowing, codes of ethics, career choice, and legal obligations. The course will relate general ethical theory to concrete problems in engineering, using readings, videotapes, scenarios, and case studies. Class sessions will vary: some possibilities are a discussion in small groups on a software liability scenario, a focused discussion of the full class on bribery, a formal debate on a conflict of interest dilemma, a role play of a meeting of characters in a scenario, and a brief lecture on protection of intellectual property.