CHITTAGONG INDEPENDENT UNIVERSITY (CIU)
UNDERGRADUATE CURRICULUM
SCHOOL OF ENGINEERING AND COMPUTER SCIENCE

In order to obtain **B.Sc. in Electronic & Telecommunication Engineering**, a student must complete a minimum of **140** credits of coursework. This includes **32** credits of Foundation Studies. The minimum requirement for the major is **93** credit hours including **6** credit hours of internship / senior project and Minor **15** credits.

Foundation Courses		**32 Credits**
Communication Skills		**6**
ENG 101	Listening and Speaking Skills	3
ENG 105	Business English	3
ENG 106	Advanced English Skills	3
Computer Skills		**3**
CSC 101	Introduction to Computer Science	3
Numeracy		**6**
MAT 102	Linear Algebra & Coordinate Geometry	3
MAT 212	Probability & Statistics for Sc. & Engr.	3
Natural Sciences		**8**
PHY 101	Physics-I	3
PHY 101L	Physics-I Lab	1
CHEM 101	Chemistry	3
CHEM 101L	Chemistry Lab	1
PHY 102	Physics-II	3
PHY 102L	Physics-II Lab	1
Social Sciences		**3**
SOC 101	Introduction to Sociology	3
HEA 101	Health and Society	3
ECN 200	Introduction to Economics	3
Humanities		**3**
FRN 101	Elementary French	3
HST 103	History and Civilization	3
ACN 201	Principles of Accounting	3
Live-in-Field Experience		
LFE 201	Live-in-Field Experience	3

Course Descriptions of Foundation Courses

ENG 101 Listening and Speaking Skills (3 credits)
Listening for main ideas and specific information, getting meaning from context, identifying stressed words and reductions, listening for advice, directions, understanding instructions, guessing meaning, inferring, predicting, listening to lectures and note taking, listening to narratives and amusing anecdotes. Speaking as social interaction, to obtain and give information, telephone conversations, introductions, greetings, partings, giving instructions, making complaints, apologies, giving directions, opinions and suggestions, expressing feelings and moods, attitudes and opinions. Classroom interaction, asking for clarification and giving explanations, descriptions, comparisons, analysis, and evaluations. Speeches, presentations, debates and discussions at seminars and conferences. Pronunciation with emphasis on intonation, stress patterns, paralinguistic, features.

ENG 105 Business English (3 credits)
The role of communication in business organization, a model of the communication process, perception and reality, the filter of the mind, some malfunctions of communication, principles of clear business writing, qualities of effective business correspondence, the direct approach letters, the indirect approach, persuasive requests and collection letters, sales letters, job applications and resume writing, office memorandums, the problems and organization of a report, determination of a report make-up, techniques of writing a report, visual aspects in a report, public speaking and oral communication.

ENG 106 Advanced English Skills (3 credits)
Advanced skills in reading- Critical reading and responding, analysis and evaluation of texts styles, comparing different purposes and registers, writing critiques of articles, text books and reviews, reading scientific and technical articles, journals and research papers. Writing in response to reading, notes, summaries, term papers, seminar and workshop presentations, collaborative writing on wider topics. Speeches and debates. Writing in narrative and expository modes. Writing research papers, abstracts, formulating thesis questions and statements, making bibliographic surveys, writing research questions for surveys and interviews, gathering and presentation of data, drawing conclusions, abbreviations and numbers, quotations, footnotes and references, bibliographies, tables, illustrations, editing and proofreading. Term paper mandatory.

CSC 101 Introduction to Computer Science (3 credits)
Introduction to Desktop personal computers. Hardware and software. Basic idea of the working of microprocessors. Storage devices. System components: Variation. Basic concepts of BIOS. Diskette Operating System. Internal and external commands. Function keys. Line editors and screen editors. Batch files. BASIC programming

language Variable and constants. Mathematical operations. Conditional branching. Looping and arrays. Dimensioning arrays. Subprograms. ho operations. Word Processing: On-and practice wit one of the word processors: Word, WordPerfect or WordStar. Will cover: Basic editing, formatting, pagination, margin control, spell checking, searching and sorting.

MAT 102 Linear Algebra & Coordinate Geometry (3 credits)

Linear algebra:

Introduction to systems of linear equations. Gaussian elimination. Definition of matrices. Algebra of matrices. Transpose of a matrix. Factorization, Determinants. Quadratic forms. Matrix polynomials. Euclidean n-space. Linear transformation from IR^n to IR^m. Real vector spaces and subspaces. Basis and dimension. Rank and nullity. Inner product spaces Gram-Schmidt process and QR-decomposition. Eigen values and Eigen vectors. Diagonalization. Linear transformations, Kernel and range. Application of linear algebra to electric networks.

Coordinate Geometry:

Coordinate Geometry of 2-dimension-change of axis, Transformation of coordinates. Simplification of equations of curves, Coordinate geometry of 3-dimension system of coordinates, distance between two points, section formula, projection, direction cosines, equations of planes and lines.

MAT 212 Probability & Statistics for Sc. & Engr. (3 credits)

Discrete and continuous random variables; probability concepts; discrete and continuous distributions; Binominal, Poisson, Normal, Exponential distributions; moments and moment generating functions; joint probability distributions; sampling distributions; confidence intervals; least-square regression; hypothesis testing; analysis of variance; Markov process, Monte-Carlo simulation.

PHY 101 Physics - 1 (3 credits)

Waves and Oscillations: Simple harmonic motion, Differential equation of simple harmonic oscillator, total energy and average energy, combination of simple harmonic oscillation, spring mass system, torsion pendulum, two body oscillation, reduced mass, damped oscillation, forced oscillation, resonance, vibrations of membranes and columns, progressive and stationary wave, group and phase velocities, sound waves-Doppler effect, Sabine's formula, architected acoustics.

Optics: Defects of images: Spherical aberration, astigmatism, coma, distortion, curvature, chromatic aberration, theories of light, Haygen's principle; Interference of light: young's double slit experiment, displacement of fringes and its uses, Fresnel bi-prism, interference in thin film, Newton's rings, interferometers, Differentiation: Diffraction by single slit, Diffraction from a circular aperture, resolving power of optical instruments, diffraction at double slit and N-slits, diffraction grating, Polarization: production and analysis of polarized light, Brewster's law, Malu's law, polarization by double refraction, Nicol prism, optical activity, polarimeters, optics of crystal optical effect in crystal, laser, nonlinear optics.

Thermal Physics: Heat and work, Zeroth law of thermodynamics, thermometer, thermocouple, the first law of thermodynamics and its applications, Kinetic theory of gases- kinetic interpretation of temperature, specific heats of ideal gases, equipartition of energy, mean free path, work done by gas, isothermal and adiabatic relations, vandarwaal's equation of state, Maxwell's distribution of molecular speeds, reversible and irreversible processes, Carnot's cycle, second law thermodynamics, Carnot's theorem, entropy, thermodynamics functions, Maxwell relations, Clausius and Clapeyron equation.

PHY 101L Lab work based on PHY1

PHY 102 Physics II (3 credits)

Atomic Structure: Rutherford scattering, atomic structure (Bohr model, Thomson model, Rutherford model), Zeeman Effect.

Structure of Matter: Classification of solids, crystal structure of solids, Bragg's law, Distinction between metal, insulator and semiconductor.

Modern Physics: Galilean relativity and Einstein's special theory of relativity, Lorentz transformation equations, Length contraction, time dilation and mass-energy relation, photoelectric effect, Compton Effect, De'Broglie matter waves.

Nuclear Physics: Constituent of atomic nucleus, nuclear binding energy, different types of radioactivity, radioactive decay law, Nuclear reactions, nuclear fission, nuclear fusion.

Mechanics: Linear momentum of a particle, linear momentum of a system of particles, conservation of linear momentum, some applications of a system particles, Kepler's law of planetary motion, the law of Universal Gravitation, the motion of planets and satellites.

Introductory Quantum Mechanics: Wave function, uncertainty principle, postulates, Schrodinger time independent equation, expectation value, probability, particle in a Zero potential, calculation of energy.

PHY102L Lab work based on PHY2

CHEM 101 Chemistry (3 credits)

Matter and energy. Modern concept of the structure of atom. Concept of the Periodic Table of elements. Concept of chemical bonds. Concept of mole, chemical reactions and ideal gas laws. Modern concept of acids and bases. Energetic and chemical equilibrium. Chemical kinetics: rate, order, rate constant and Arhenius equation. Concepts of catalysis and photochemical reactions. Organic chemistry: concepts of saturated hydrocarbons, unsaturated hydrocarbons, alcohols, fatty acids and aromatic hydrocarbons. Concept of chemical industries in Bangladesh: case studies: chemical fertilizer, paper, sugar and leather.

CHEM 101L Lab work based on CHEM1

SOC 101 Introduction to Sociology (3 credits)

Introductory Sociology is designed to acquaint the beginning students with the major concepts and theories. With a brief discussion of its history and contributions of the major sociologists the course introduces the students to the methodology of social research. The course then looks at the major concepts, like culture, groups, socialization, deviance and social control. The next section deals with social inequality in terms of social stratification, global inequality, and inequalities among ethnic groups, gender and of age. It then moves to the different institutions like, family, religion, education, economy, and government and politics. The next section deals with population, environment, urbanization and finally with collective behaviour and social movements and social change.

HEA 101 Health and Society (3 credits)

This course aims to introduce students to an understanding of key sociological approaches to the analysis and understanding of health and society. The course covers concepts of health and disease, patterns of health and the social construction of disease. Special attention is given to develop knowledge on theories central to the notion of health, including the social, cultural and institutional forces and context that play a role on health and health related practices. The purpose is to help establish a perspective that will enable the students to better understand the relationship between health and society as well as to provide skills and knowledge for research experiences. The course also provides an overview of the basic concepts of population studies that will help students develop their own demographic perspective, enabling them to understand some of the most important issues confronting the world. The course will use a combination of methods, such as lectures, debates, preparation of assignments by reviewing journal articles and presentation.

ECN 200 Introduction to Economics

Basic concepts of economics. Distinction between Micro and Macro Economics. General view of price system: Demand and Supply. Elasticity of demand and supply. Consumer's behavior: Utility analysis, Inferior good and Giffen good. Market structures: Perfect competition, Monopoly, Monopolistic competition and Oligopoly. Factors of production: labor, land, capital and entrepreneur. Basic concepts of Macroeconomics. Circular flow of income, mixed economy, private and public sector economic interactions. Measuring domestic output: national income and the price level. Aggregate Expenditures Model. The Multiplier, net exports, and government. Aggregate demand and aggregate supply of money. Money market equilibrium.

Credit creation by banking system. Monetary policy. Some concepts of international Trade, exchange rate determination and economic development.

HST 103 History & Civilization (3 credits)

Meaning, Growth and Spread of civilization The Ancient Near East: Mesopotamia- Egypt- The Hebrews- The Hittites Canaanites - Philistine - Phoenicians - Crete - Mycenea _ The Classical World the Greeks and the Romans - The Medieval Age: Christianity, Barbarian invasions, Feudalism, Manorial System, Growth of towns and

Universities - Byzantine civilization and the formation of Russia - Early Culture in America: The Mayas, the Aztecs, the Incas - The Renaissance and the Reformation - Government and Societies in the Age of Absolutism - The Age of Explorations – The formation of Latin American - the Scientific and Industrial Revolutions – Consolidation of Europe's Global dominance - World War I - The Bolshevik Revolution in Russia.

FRN 101 Elementary French I (3 credits)
Letters of alphabet. Accents and their pronunciation. Definite and indefinite articles (feminine/masculine, singular/plural). Personal pronouns. Auxiliaries "to be" and "to have", verbs ending with '-er', in the present tense. Interrogative, negative form. Simple adjectives (descriptive, colours). Presenting onself.

ACN 201 Principles of Accounting
An introduction. The recording Process. Adjusting the Accounting and Preparing the Statements. Completion of the Accounting Cycle. Accounting for Merchandizing operation. Special journals. Preparation of Income Statement and Balance sheet for companies. (According to Company Act 1994). Introduction to Accounting Principles.

Core Courses		40 Credits
CCR 205	Programming Concepts	3
CCR 205L	Lab work based on CCR 205	1
ECR 101	Introduction to Electrical Engineering	3
ECR 101L	Lab work based on ECR 101	1
ECR 205	Digital Circuits	3
ECR 205L	Lab work based on ECR 205	1
ECR 206	Circuits & Systems	3
ECR 206L	Lab work based on ECR 206	1
ECR 207	Electronics I	3
ECR 207L	Lab work based on ECR 207	1
ECR 209	Microprocessors and Interfacing	3
ECR 209L	Lab work based on ECR 209	1
ECR 250	Numerical Methods for Engineering	3
ECR 250L	Lab work based on ECR 250	1
ECR 301	Telecommunication Systems I	3
ECR 301L	Lab work based on ECR 301	1
ECR 305	Introduction to Digital Signal Processing	3
ECR 305L	Lab work based on ECR 305	1
ECR 407	Electronics II	3
ECR 407L	Lab work based on ECR 407	1
Concentration		**38 Credits**
ETE 303	Telecommunication Networks I	3
ETE 303L	Lab work based on ETE 303	1
ETE 304	Telecommunication Networks II	3
ETE 304L	Lab work based on ETE 304	1
ETE 309	High Frequency Electromagnetic Waves	3
ETE 403	Network Management	3
ETE 403L	Lab work based on ETE 403	1
ETE 404	Optical Communication	3
ETE 405	Digital Modulation & Coding	3
ETE 405L	Lab work based on ETE 405	1
ETE 406	Telecommunication Systems II	3
ETE 406L	Lab work based on ETE 406	1
ETE 410	Wireless Data Communication Systems	3
ETE 410L	Lab work based on ETE 410	1

ETE 450	Computer and Network Security	3
ETE 450L	Lab work based on ETE 450	1
ETE 455	Web Applications and Internet	3
ETE 455L	Lab work based on ETE 455	1
Optional Courses (Any three)		**9 Credits**
ETE409	Computer Systems Engineering	3
ETE 412	Mobile & Satellite Communication Systems	3
ETE 416	Microwave Engineering	3
ETE 418	Embedded Systems	3
ETE 420	Telecommunication Management	3
ETE 421	Internet and Multimedia	3
ETE 431	Microelectronics	3
ETE 433	Engineering Economics & Finance	3
ETE 435	Robotics	3
ETE 445	Energy & Environment	3
ETE 490	Special Topics in Electrical & Telecommunication Engineering	3
Internship Program or Senior Project		**6 Credits**
ETE 498	Senior project	6
ETE 499	Internship Program	6

Course Description of Major in **Electronic & Telecommunication Engineering**

Core courses

CCR 205 Programming Concepts: (3 credits)

Introduction to digital computers.

Programming languages, algorithms and flow charts.

Structured programming using C:

Variables and constants, operators, expressions, control statements, functions, array, pointer, structure union, user defined data types, Input-Output files.

Object Oriented Programming using C++:

Introduction, Classes and Objects, Polymorphism, Function and Operator Overloading, Inheritance.

CCR 205L Lab work based on CCR 205 (1 credit)

ECR 101 Introduction to Electrical Engineering: (3 credits)

Electrical Circuit Concepts & Units- Voltage, Current, Power & Energy, Resistance & Conductance, Ohms Law, KVL, KCL, Series & Parallel dc Circuits & networks.

Methods of Analysis- Branch-Current Analysis, Node & Mesh Analysis, Bridge Networks, Y-Δ transformation.

Network Theorems- Superposition, Thevenin's, Norton's, Maximum Power Transfer Theorem & Reciprocity Theorem.

Energy Storage Elements- Inductors & Capacitors & Their Characteristics, Series-Parallel Combination of Inductors & Capacitors.

Responses of RL & RC Circuits- Natural & Step Responses.

Magnetic Quantities & Variables- Flux Permeability & Reluctance, Magnetic Field Strength, Magnetic Potential, Flux Density Magnetization Curve.

Laws in Magnetic Circuits- Ohm's Law, Ampere's Circuit Law, Series & Parallel Magnetic Circuits.

ECR 101L Lab work based on ECR 101 (1 credit)

ECR 205 Digital Circuits (3 credits): Realizations of combinational circuits: MSI devices, ROM's. PLA's. synchronous. sequential logic circuits: latches, flip flops, counters, registers. Algorithmic state machines: systematic design procedures. A Synchronous sequential logic circuits, design applications. PLD's, VHDL.

ECR 205L Lab work based on ECR 205 (1 credit)

ECR 206 Electrical Circuits (3 credits)

Analysis of Single Phase AC circuits:

Series and Parallel RL, RC and RLC circuits, Resonance in AC circuits, Series and Parallel resonance. Q of a circuit, nodal and mesh analysis, application of network theorems in AC circuits, Circuits with non-sinusoidal excitations, transient in AC circuits,

Analysis of poly phase Circuits:

Poly phase supply, 3-phase conditions, balanced and unbalanced circuits, power calculation.

Magnetically couple circuits:

Self and mutual inductances, coupling co-efficient, reflected impedance, transfer impedance.

Two port networks (TPN):

Two port networks (symmetrical & asymmetrical), determination of two port parameters, relationship between two port parameters, equivalent. π and T equivalent networks.

Filter:

Passive filters, fundamental equations of an ideal filter, theorem connecting characteristics impedance and attenuation, impedance matching of filters, composite filters, band pass and band stop filters.

CCR 206L Lab work based on CCR 206 (1 credit)

ECR 207 Electronics I (3 credits)

P-N Junction as a Circuit Element:

Intrinsic and extrinsic semiconductors, operational principles of p-n junction diode, contact potential, biasing of diode, current-voltage characteristics of a diode, simplified DC and AC diode models, dynamic resistance and capacitance.

Diode Circuits:

Half wave and full wave rectifiers with filter capacitor, characteristics of a Zener diode, Zener shunt regulator, clamping and clipping circuits.

Bipolar Junction Transistor (BJT):

Voltage and current gain, input output impedance of common base, common emitter and common collector amplifier circuits, multistage amplifiers.

Metal Oxide Semiconductor Field Effect Transistor (MOSFET):

Structure and physical operation of an enhancement MOSFET, threshold voltage, body effect, current-voltage characteristics of an enhancement MOSFET, biasing discrete and integrated amplifier circuits, single-stage MOS amplifier, MOSFET as switch, introduction to VMOS and CMOS inverter, Differential and ,multistage amplifiers, small-signal operation, differential and common mode gains.

Junction Field-Effect-Transistor (JFET):

Structure and physical operation of JFET, transistor characteristics, pinch-off voltage.

ECR 207L Lab work based on ECR 207 (1 credit)

ECR 209 Microprocessors & Interfacing (3 credits): The programmer's model of a microprocessor: writing assembly language programs. The hardware model of a microprocessor: synchronous and asynchronous busses. Interfacing concepts: I/O Organization, address decoding, static and dynamic memory interfacing. Direct I/O for simple peripherals. I/O support devices: PIAs, ACIAS. Interrupt-driven I/O: interrupt vectors, interrupt handlers, DMA controllers.

Standard microcomputer busses: VME, EISA, SCSI and others. Laboratory interfacing experiments using 8-bit and 16-bit hardware, assembly language software, real-time kernels and operating systems.

ECR 209L Lab work based on ECR 209 (1 credit)

ECR 250 Numerical Methods for Engineering (3 credits)
Introduction:
Motivation and errors in numerical techniques, Taylor series.
Finite Difference Calculus:
Forward, backward, divided, and central difference and difference of polynomial.
Interpolation and Extrapolation:
Iteration, bisection, false position. Raphson, Secant and Muller's methods.
Simultaneous Linear Algebra Equations:
Cramer's rule, Inversion of matrices, Gauss elimination, Gauss-Jordon method, factorization and Gauss-Siedel iteration methods.
Curve fitting:
Linear and polynomial regression, fitting power, exponential and trigonometric functions, ordinary differential equations, initial value problem, Taylor's series method, Picard's methods of successive approximation, Euler's method and RungeKutta method, Boundary value problems.
Numerical Integration:
General quadratic formula, trapezoidal rule and Simpson's rule, numerical differentiation.

ECR 250L Lab work based on ECR 250 (1 credit)

ECR 301 Telecommunication Systems I (3 credits): To present a general introduction to telecommunications aspects such as signal acquisition, transmission and processing in communication systems. This subject is intended for telecommunication engineering students as a necessary background, and also for electrical or computer engineering students not specializing in telecommunications as a general knowledge. Including: Characteristics of typical communication channels; Typical signals (speech, audio, video, data) and their characteristics; Basic analogue and digital techniques; Key techniques in handling transmission system issues (modulation, coding, multiplexing, etc); System performance and evaluation (channel noise, inters symbol interference, bit error rate, etc.); Major communication systems including telephony, radio, TV, satellite, mobile phone, optical fiber, radar and networks.

ECR 301L Lab work based on ECR 301 (1 credit)

ECR 305 Introduction to Digital Signal Processing (3 credits): The mathematics of signals and linear systems. Fourier and Laplace transforms, discrete Fourier and Z transforms. Analogue filters: approximation theory, Butterworth, Bessel, Chebyshev and elliptic filters. Filter impulse and frequency responses, stability, and sensitivity. Sampling continuous signals: the sampling theorem, reconstruction, and aliasing. The discrete Fourier transform (DFT) and the fast Fourier transform (FFT). Fundamentals of the design and realization of finite impulse response (FIR) and infinite impulse response (IIR) digital filters. Digital processing of analog signals, including

applications of digital signal processing (DSP) and programmable DSP chips. The representation and modeling of non-deterministic (random) signals, correlation functions, and power density spectra.

ECR 305L Lab work based on ECR 305 (1 credit)
ECR 407 Electronics II (3 credits)
Frequency Response of Amplifier:
Poles, Zeros, and Bode plots, amplifier transfer function, techniques of determining 3 dB frequencies of amplifier circuits, frequency response of single-state and cascade amplifiers, frequency response of differential amplifiers.
Operational Amplifiers (Op-Amp): Properties of ideal Op-Amps, non-inverting and inverting amplifiers, inverting integrators, differentiator, weighted summer and other applications of Op-Amp circuits, Electronic Analog computation Schmitt trigger, Differential Amp, Differential and common gain, comparators, effects of finite open loop gain and bandwidth on circuit performance, logic operation of Op-Amp
Feedback Amplifiers:
Properties, basic topologies, feedback amplifiers with different topologies, stability, frequency compensation.
Active Filters:
Different types of filters and specifications, transfer functions, realization of first and second order law, high and band pass filters using Op-Amps.
Oscillators and Timing Circuits:
Sinusoidal oscillators, Phase shift oscillator, resonant circuit oscillator, general form of oscillator circuit, wein-bridge oscillator, crystal oscillators, Bi-stable, mono-stable, Astablemultivirators, IC555 and its applications. VCO, PLL and Blocking oscillator.

ECR 407L Lab work based on ECR 407 (1 credit)

Concentration: 38 Credits

ETE 303 Telecommunication Networks I (3 credits): Circuit Switching (telephony) and Packet Switching (data) networks. Qualify of service (QOS), flexibility and cost. Telecommunication systems. The OSI/ISO reference model. Evolution of the telephone system architecture. Digital switching and multiplexing. Packet switching. Traffic engineering. Flow and congestion control. Network management. Network security. Speech, video and data compression. Internetworking. TCP/IP reference model. LANs, MANs and FDDIs.

ETE 303L Telecommunication Networks Lab I (1 credit)

ETE 304 Telecommunication Networks II (3 credits): This subject provides insight into how to design, analyze and evaluate performance of the telecommunication networks. The subject identifies the benefits of high speed networks such as effectiveness, cost and customer control. It also describes the functions and characteristics of several services and technologies, including Personal Communication Services, Frame Relay, Asynchronous Transfer Mode (ATM), SONET/SDH and Switched Multimegabit Data Services; Protocol modeling and verification

techniques; ATM LANs, multimedia communication; Analysis of protocols for data link, network and transport layers; Network design; Operating system views of communication.

ETE 304L Lab work based on ETE 304 (1 credit)

ETE 309 High Frequency Electromagnetic Waves (3 credits): Maxwell equations & electromagnetic waves; polarization & TEM waves; plane & spherical waves; Interference principles; Energy & power in waves; Group velocity dispersion & group delay; Dielectric materials & transmission; conducting materials & shielding; nonlinear interactions; anisotropic materials; Transmission lines from circuit & electromagnetic viewpoints; transmission line circuits; Metallic & dielectric waveguides; waveguide modes; Dipole, array, dish & aperture antennas; Some health & environmental considerations.

ETE 403 Network Management (3 credits): This course will introduce students to methods, techniques and tools for the management of telecommunication systems and networks with specific examples from Internet and the public switched telecommunication networks. It will introduce the fundamental models that are used In the Internet (SNMP), and the telecommunication networks (TMN). In addition it will look In detail at the QOS management of IP base communications networks, by examining the emerging IETF protocols associated with Inter server and Diff server architectures.

ETE 403L Lab work based on ETE403 (1 credit)

ETE 404 Optical Communication (3 credits): Wave propagation in single mode and multimode optical fibers. Step-index and graded index fibers. Gaussian approximation of fields in single mode fiber, spot size, equivalent step index of single mode fiber. Material, waveguide and internodes dispersions. Polarization and birefringent fibers. Ray theory, optimal profile, mode coupling in multimode fiber. Optical fiber measurement and characterization. Launching efficiencies in multimode and single mode fibers. *(Prerequisite: ECR 301, Senior Stnading)*

ETE 405 Digital Modulation & Coding (3 credits): Provides detailed understanding of techniques used to process digital information in order to ensure its reliable delivery over noisy channels. Examines the fundamental resources available to telecommunication systems and develops techniques for understanding the implications of different modulation and coding techniques on these fundamental quantities. The course also provides a general understanding of the role of digital modulation and coding in practical digital communication systems. Brief review of key concepts from signal processing, linear systems, sampling theory and source coding. Digital transmission through AWGN channels. Base band signaling and pulse shaping. Carrier amplitude, phase and frequency modulation techniques. Spread spectrum modulation. Carrier and clock synchronization. Channel capacity. Forward error correction coding. Applications of these techniques in typical digital communications systems.

ETE 405L Lab work based on ETE 405 (1 credit)

ETE 406 Telecommunication Systems II (3 credits): This subject provides a fundamental coverage of important communication systems, their basic components, as well as legal and commercial aspects affecting the design and operation of these systems. This subject is intended for students who wish to major in telecommunications or to strengthen their knowledge of modern communication systems. Basic principles of guided and unguided wave propagation. Transmission aspects of voice telephony, digital networks signaling, CCITT signaling system, Asynchronous Transfer Mode (ATM), Advanced Broadband Digital Transport Formats. Broadcast radio and TV systems. Cable systems. Introduction to mobile and satellite communications.

ETE 406L Lab work based on ETE 406 (1 credit)

ETE 410 Wireless Data Communication Systems (3 credits): The subject will introduce the participants to the state of the art in the area of wireless data communications. It will focus on principles, technologies, system architectures, and standards for wireless access networks, including both fixed and mobile services. In particular: Introduction to Wireless Technologies; First, Second, and Third Generation Wireless Networks; MAC Technologies for Wireless, Packet Switching, Circuit Switching, Burst Switching; Radio Resource ; Allocation and Cellular Systems; Cellular Digital Packet Data network; GSM Architecture: Routing and Flow Control Protocols, Mobility Management; High-Speed Circuit-Switched Data Services General Packet Radio Service; Enhanced Data for Global Evolution and Global Third Generation; Wireless Local Area Network and Hyperlan Standards, Their Architecture; Broadband Wireless Access Standards; Applications of Wireless Services; Future Wireless Services and Software Radios.

ETE 410L Lab work based on ETE 410 (1 credit)

ETE 450 Computer and Network Security (3 credits)
Introduction; nature and types of security attacks, model for network security, Fiestel cipher structure; conventional encryption algorithms, DES and triple DES, public key cryptography, message authentication, hash function, RSA and Diffie-Hellman algorithms, digital signature, digital certificate, key distribution, system security, intrusion and password protection, intrusion detection system, viruses, worms and anti-virus techniques, firewall architecture and design, trusted system, network security, Kerberos, X.50g, e-mail security, PGP and S/MIME, IP Security architecture, secure socket layer, secure electronic transaction, network management security and SNMP, JAVA security, CGI security, security features of windows NT, UNIX and LINUX. (Prerequisite: CSC 430 and Senior Standing)

ETE 450L Lab work based on ETE 450 (1 credit)

ECR 455 Web Applications and Internet (3 credits): Web Technology - OSI & TCP/IP architecture, Internet Routing, IP addressing & Domain Name System. World Wide Web - overview of popular browsers; Anatomy of Web presentations. Designing HTML files- Mark up

tags, hypertext linking, Images & graphics, Tables, Forms, Multimedia. Scripting languages- JavaScript, CGI. DHTML: Cascading Style Sheet, scripting. Web Servers - IIS, PWS, Apache. Understanding HTTP, Client and Server side scripts. Concept of designing dynamic Web pages: ASP, PHP, with MS Access, SQL server. Working with remote data services - using ASP, PHP technologies with MySQL and Oracle database. Web security: Cryptography, Digital signature, Digital Certificate, Authentication & Firewall. (Prerequisite: CSC 305, CSC 401,Senior Standing)

ECR 455L Lab work based on ECR 455 (1 credit)

Optional Courses (any three) 9 credits

ETE 409 Computer System Engineering (3 credits)
Computer system: computer structures, components, functions, memory, I/O devices, modules, programmed and interrupt driven I/I, I/O channels and processors, interfaces; Computer peripherals: Displays, mass storage systems, printers, touch screens, digitizers, etc.; Computer network: network requirements, architecture, protocol stack models, Ethernet, Token Ring, Wireless, and FDDI networks, bridges, switching and routing in IP and ATM networks, and Internetworking.

ETE 412 Mobile & Satellite Communication Systems (3 credits): A specialized subject, aimed to provide a fundamental understanding of the system architecture and system design, and the effect of the channel on the performance of two of the most important digital telecommunications systems, i.e. digital cellular mobile communication and digital satellite communication. It shows how digital modulation and coding techniques taught in ETE405 Digital Modulation and Coding may be used to improve the reliability of each system. It also provides a general understanding of these systems from the network perspective. Modern communication systems from a systems point of view. Cellular mobile communication systems. Propagation-loss model. The mobile fading channel. Multiple access techniques. The GSM. Digital satellite communication systems. Satellite orbits. Station keeping. Multiple access techniques. System synchronization. DAMA. Satellite packet communication. Mobile satellite networks.

ETE 416 Microwave Engineering (3 credits): Microwave amplifiers, oscillators, mixer and detectors, and electronic switches are basic components of microwave systems. The performance of these components is critical to system performance. This module therefore teaches the design of these components to satisfy performance specifications. Topics covered: Amplifiers: theory, LNA and multistage design; Oscillator theory: nonlinear negative resistance, startup, stability, power generation; Gunn and IMPATT diode oscillators; Design of planar passive components and their application; PIN diode switch and phase shifter analysis and design; Mixers and detectors: theory, mixer and detector diodes, diode detectors and mixers.

ETE 418 Embedded Systems (3 credits): Provides a detailed overview of the important topics in the field. Typical examples of embedded systems; real time and safety critical issues; constraint driven design; systems integration; hardware-software partitioning and time-to-market considerations will be addressed. The subject will examine programmable devices, micro-controllers, application specific standard processors: importance of interrupts; re-configurable logic; system-on-a-chip; finite state machines; dataflow architectures; and distributed embedded systems. Software for embedded systems, including: programming languages and software architectures; interrupt servicing; multi-tasking; task communications and scheduling; verification: hardware-software co-simulation; and real-time operating systems will be introduced.

ETE 420 Telecommunication Management (3 credits): Tracking and assessing telecommunication technology and making technology transition plan; planning, designing and operation of telecommunication systems; managing intellectual property; technology development, adaptation, and transfer; r adio frequency management, allocation of spectrum, regulations for spectrum use, common carriers, Satellite and cables, competition and compliance, ITU; long term policy planning; Management and organization of electronics and telecommunications industry.

ETE 421 Internet & Multimedia Communication (3 credits): Develops an in-depth knowledge of the concepts, principles and implementation techniques related to the Internet and web technology. Details about the Internet, Intranet, and Extranet, will be covered. Web server management, threats, security of client and server, network security like firewall, SSL, authentication and authorization, search engine, Internet protocols like TCP/IP, SGML, XML; Design and developments of Web applications using Java Applets, ASP, Java Script, CGI and other Web tools are discussed.

ETE 431 Microelectronics (3 credits): Design techniques for hybrid microelectronics, analog integrated electronic circuits, materials and processing, design of monolithic integrated circuits, and hybrid integrated circuits; thick film circuits, thin film circuits, multichip modules, interconnects, electronic packaging, processing and fabrication of IC technologies.

ETE 433 Engineering Economics & Finance (3 credits): Introduction and review of basic concepts of engineering economics and engineering finance; marginal analysis; money and its management; debt management ; project worth analysis; rate of return analysis; project risk and uncertainty; theory and applications of engineering finance; designing, structuring, pricing and financing of engineering products, options, futures, swaps and other securities; financial & investment risk management; tools of mathematical finance, stochastic processes; stochastic interest rates; derivative trading & arbitrage; multivariate stochastic methods in finance; Black–Scholes theory; discrete-time Markov chain, Monte–Carlo simulation.

ETE 435 Robotics (3 credits) Rigid Motions and Homogeneous Transformation; Forward Kinematics: Common robot configurations; Denavit-Hartenberg convention; A-matrices; T-

matrices; Inverse kinematics: Planar mechanisms; geometric approaches; spherical wrist; Velocity kinematics: Angular velocity and acceleration; Motions planning: Configuration space; artificial potential fields; randomized methods; collision detection; Trajectory generation: Joint space interpolation; polynomial splines; trapezoidal velocity profiles; minimum time trajectories; Feedback control: Actuators and sensors; transfer functions; tracking and disturbance rejection; PID control; feed forward control; resolved motion rate control; Vision-based control: The geometry of image formation; feature extraction; feature tracking; the image Jacobian; visual servo control Advanced Topics (one or more of the following depending on the instructor): Lagrangian dynamics; parallel robots; mobile robots; force sensing and force control; machine learning; advanced topics in vision; student projects; other.

ETE 445 Energy & Environment (3 credits) Energy conversion and the laws of Thermodynamics; chemistry of fossil fuel conversion; reaction, kinetics, entropy; availability; Gibbs function; heat engines; atmospheric & hydrologic pollution and energy conversion; nuclear energy; principles of conversion; fuel cycle; environmental issues; renewable energy resources; solar, wind, biomass and other sources of renewable energies; thermodynamics of renewable energy resources; economics of energy conversion and environmental effects.

ETE 490 Special Topics in Electronic & Telecommunication Engineering (3 credits): Special topics, whose contents are approved by the Academic Council, will be covered in this course.

ETE 498 Senior Project (6 credits): Students have to take either ETE 498 or ETE 499.

ETE 499 Internship (6 credits): Students have to take either ETE 498 or ETE 499.

Minor in Engineering Mathematics		15 Credits
Students majoring in Electrical & Telecommunications Engineering must take engineering mathematics as their minor. Students taking this minor will be adequately trained in mathematics to understand its application in fields of Electrical and Telecommunication Engineering.		
Compulsory Courses		**12 Credits**
MAT 201	Calculus	3
MAT 251	Complex Variables & Vector Analysis	3
MAT 303	Differential Equations	3
MAT 305	Boundary Value Problems	3
Optional Courses – Anyone from the following		**3 Credits**
MAT 403	Introduction to Mathematical Modeling	3
MAT 405	Optimization Techniques	3

Course Description of Minor in Engineering Mathematics

MAT 201 Calculus I (3 credits): Functions (and their visualization. limits, derivatives . and integrals. Successive differentiation. Additional techniques of integration. Interpretations of the derivative, applications of the derivative to geometry, mechanics, marginality and optimization. Newton's method. Introduction to modeling. Definite integral, interpretations and properties of the definite integral, applications of the definite integral to geometry, mechanics, economics and modeling. Approximating definite integral, approximation errors and Simpson's rule, improper integrals. Taylor polynomials and series, convergence of series, finding and using Taylor's series, indeterminate forms, Fourier series. First order differential equations: Slope fields, Euler's method, separation of variables, linear equations, applications and modeling.

MAT 251 Complex Variables & Vector Analysis (3 credits): Calculus of vector functions, change of parameter, arc length, unit tangent and normal vectors, curvature, motion along a curve. Functions of several variables, visualization, limits and continuity, partial derivatives, differentiability and chain rules, Jacobians, tangent planes, total differentials, exact differential equations, directional derivatives and gradients, optimization. Double and triple integrals, change of variables, double integrals in polar coordinates, triple integrals in cylindrical and spherical

polar coordinates, surface area and volumes. Vector calculus: Vector fields, divergence and curl, line integrals, independence of paths, conservative vector fields, Green's theorem, surface integrals, divergence and Stokes' theorems.

MAT 303 Differential Equations (3 credits)
Ordinary differential equations:
Degree and order of ordinary differential equations, formation of differential equations by various method, solution of first order differential equations. Solution of general linear equations of second and higher order with constant coefficients, applications. Solution of homogeneous linear equation of the higher order when the dependent or independent variables are absent. Solution of differential equations by the method based on the factorization of the operators. Frobenious method. Legendre and Bessel's function.
Partial Differential Equations:
Introduction linear and on-linear first order equations. Standard forms. Linear equations of higher order. Equations of the second order with variable coefficients. Wave equations. Particular solution with boundary and initial conditions.

MAT 305 Boundary Value Problems (3 credits): Bessels functions; Legendre polynomials; Fourier series; half wave and full wave expansions; solutions of Laplace equation, Poisson's equation, wave equation and diffusion equation in orthogonal and non-orthogonal coordinate systems; Sturm-Liouville problem.*(Prerequisite: MAT 251)*

MAT 403 Introduction to Mathematical Modeling (3 credits): An introduction to techniques of mathematical modeling involved in the analysis of meaningful and practical problems in many disciplines including mathematical sciences, operations research, engineering and the management and life sciences. Students will be encouraged to recognize and formulate problems in mathematical terms, solve the resulting mathematical problems and interpret the solution in real terms. *(Prerequisite: MAT 303 and. Permission of the instructor)*

MAT 405 Optimization Techniques (3 credits): Discrete, deterministic models of interest to social sciences. Linear programming, duality, simplex method, sensitivity analysis, convex sets. Selections from assignment, transportation, network flow, nonlinear programming problems.