Noakhali Science and Technology University

Syllabuses of the

Department of Computer Science and Telecommunication Engineering

for

4-Year B.Sc. Engineering Course for the Sessions: 2009-10 to 2018-19.

Published by

The Noakhali Science and Technology University

Sonapur, Noakhali-3814, Bangladesh.

Year 1 Term 1 :

Course Code	Course Title	Credit	Credit Hours	Page
CSTE 1101	Introduction to Computer Application	3.0	3.0	5
CSTE 1102	Introduction to Computer Application Lab	1.5	3.0	5
CSTE 1103	Fundamentals of Electrical and Mechanical Engineering	3.0	3.0	5
PHYS 1101	Electromagnetism, Oscillations and Optics	3.0	3.0	5
PHYS 1102	Physics Lab	1.5	3.0	6
MATH 1101	Differential and Integral Calculus	2.0	2.0	6
FENG 1101	Developing Basic English Skills	2.0	2.0	7
HUM 1101	Financial and Cost Accounting	3.0	3.0	7
	Total	**19.0**	**22.0**	

Year 1 Term 2:

CSTE 1201	Structured Programming Language	3.0	3.0	7
CSTE 1202	Structured Programming Language Lab	1.5	3.0	8
CSTE 1203	Discrete Mathematics	3.0	3.0	8
CSTE 1205	Electric Circuit Analysis	3.0	3.0	8
CSTE 1206	Electric Circuit Analysis Lab	0.75	1.5	8
CSTE 1207	Semiconductor Devices and Circuits	3.0	3.0	8
CSTE 1208	Semiconductor Devices and Circuits Lab	0.75	1.5	9
MATH 1203	Matrices, Ordinary and Partial Differential equations	3.0	3.0	9
HUM 1203	Industrial and Business Management	3.0	3.0	9
FENG 1203	English for Specific Purposes	2.0	2.0	10
CSTE 1210	Project Work and Seminar / Viva Voce	1.0	0.0	10
	Total	**24.0**	**26.0**	

Year 2 Term 1 :

CSTE 2101	Object Oriented Programming	3.0	3.0	10
CSTE 2102	Object Oriented Programming Lab	1.5	3.0	11
CSTE 2103	Digital Logic Design	3.0	3.0	11
CSTE 2104	Digital Logic Design Lab	0.75	1.5	11
CSTE 2105	Numerical analysis	3.0	3.0	11
CSTE 2106	Numerical analysis Lab	0.75	1.5	12
CSTE 2107	Introduction to Telecommunication	3.0	3.0	12
MATH 2105	Vector Analysis, Laplace Transform and Fourier Analysis	3.0	3.0	12
HUM -2105	Principles of Economics	3.0	3.0	12
	Total	**21.0**	**24.0**	

Year 2 Term 2:

CSTE 2201	Data Structure and Algorithms	3.0	3.0	13
CSTE 2202	Data Structure and Algorithms Lab	1.5	3.0	13
CSTE 2203	Digital Electronics and Pulse Technique	3.0	3.0	13
CSTE 2204	Digital Electronics and Pulse Technique Lab	0.75	1.5	13
CSTE 2205	Computer Architecture and Organization	3.0	3.0	13
CSTE 2206	Computer Architecture and Organization Lab	0.75	1.5	14
CSTE 2207	Object Oriented Programming in GUI Environment	3.0	3.0	14
CSTE 2208	Object Oriented Programming in GUI Environment Lab	1.5	3.0	14
CSTE 2209	Theory of Computation	3.0	3.0	14
MATH 2207	Complex variables, Statistics and Probability	3.0	3.0	15
CSTE 2210	Project Work and Seminar / Viva Voce	1.0	0.0	15
	Total	**23.5**	**24.0**	

Year 3 Term 1 :

CSTE 3101	Electronic Communication	3.0	3.0	15
CSTE 3102	Electronic Communication Lab	0.75	1.5	16
CSTE 3103	Digital Signal Processing	3.0	3.0	16
CSTE 3104	Digital Signal Processing Lab	0.75	1.5	16
CSTE 3105	Database Management System	3.0	3.0	16
CSTE 3106	Database Management System Lab	1.5	3.0	17
CSTE 3107	Operating Systems and System Programming	3.0	3.0	17
CSTE 3108	Operating Systems and System Programming Lab	0.75	1.5	17
CSTE 3109	Microprocessor, Microcontroller and Interfacing	3.0	3.0	18
CSTE 3110	Microprocessor, Microcontroller and Interfacing Lab	0.75	1.5	18
CSTE 3111	Electromagnetic Waves and Radiating Systems	3.0	3.0	18
	Total	**22.5**	**27.0**	

Year 3 Term 2 :

CSTE 3201	Computer Networking	3.0	3.0	18
CSTE 3202	Computer Networking Lab	0.75	1.5	19
CSTE 3203	Microwave and Satellite Communication	3.0	3.0	19
CSTE 3204	Microwave and Satellite Communication Lab	0.75	1.5	19
CSTE 3205	Web Technologies	3.0	3.0	20
CSTE 3206	Web Technologies Lab	1.5	3.0	20
CSTE 3207	Digital Communication	3.0	3.0	20
CSTE 3208	Digital Communication Lab	0.75	1.5	20
CSTE 3209	Software Engineering and Information System Design	3.0	3.0	20
CSTE 3210	Software Engineering and Information System Design Lab	1.5	3.0	21
CSTE 3211	Wireless Communication and Networks	3.0	3.0	21
CSTE 3212	Wireless Communication and Networks Lab	0.75	1.5	21
CSTE 3214	Project Work and Seminar / Viva Voce	1.0	0.0	21
	Total	**25.0**	**30.0**	

Year 4 Term 1 :

CSTE 4101	Computer Graphics	3.0	3.0	21
CSTE 4102	Computer Graphics Lab	0.75	1.5	22
CSTE 4103	Artificial Intelligence and Neural Networks	3.0	3.0	22
CSTE 4104	Artificial Intelligence and Neural Networks Lab	0.75	1.5	22
CSTE 4105	Optical Fiber Communication	3.0	3.0	22
CSTE 4106	Optical Fiber Communication Lab	0.75	1.5	23
CSTE 4107	Cellular Mobile System & Network Management	3.0	3.0	23
CSTE 4109	Compiler Construction	3.0	3.0	23
CSTE 4110	Compiler Construction Lab	0.75	1.5	23
CSTE 4111	Project and Thesis	0.75	1.5	23
CSTE 4112	Industrial Training	0.75	0.0	24
	Total	**19.5**	**22.5**	

Year 4 Term 2:

CSTE 4201	Client Server Technology or Digital Image Processing	3.0	3.0	24
CSTE 4202	Client Server Technology Lab or Digital Image Processing Lab	1.5	3.0	24
CSTE 4203	Multimedia Communications	3.0	3.0	24
CSTE 4205	Cryptography and Network Security	3.0	3.0	25
CSTE 4207	Advanced Wireless Communication	3.0	3.0	25
CSTE 4208	Project and Thesis	3.0	6.0	26
CSTE 4210	Viva Voce	1.0	0.0	26
	Total	**17.5**	**21.0**	
Grand Total		**172.0**	**196.5**	

Year-1 Term-1

CSTE 1101 Introduction to Computer Application
3 Hours/Week, 3 Credits

Computer Basis: History and development Computer types. Scope of computer Impact of computers on society and technology. **Specification of Computers:** CPU types, Speed variation, Memory, type size Cache, Storage Media, Hard disk, Floppy disk, CD ROM, DVD. **Printer:** Dot matrix Laser, ink jet. **Computer Hardware:** Digital electronics, CPU. **Memory:** RAM, ROM, Mass storage devices, **I/O Devices**: Different Peripherals **Idea of System Software and Application Software:** Function of Operating System, Discussion on different types of Operating System : DOS/Windows, Mac UNIX/XENIX etc. **Concept of formal Language:** Different type of Computer Languages: Assembly, FORTRAN, Pascal C and C++, Artificial Language etc. **Purpose and Scope of Application Packages:** Essential General purpose packages: Word Processing, Spreadsheet analysis, Database etc. **Networking:** Different types of networks, network topologies, communication media. **Internet:** Internet services, e-mail, e-commerce. **Multimedia:** Basics of audio, video & graphics. **Maintenance and Troubleshooting:** Classification of Stabilizer, UPS and IPS, Effect of Static charge on computer devices, Virus, Power Surge Protection, Disk maintenance. **Future Trends:** Super Computer, Distributed Computer, Parallel Processing, Information Super Highway, Multi-media and virtual reality.

CSTE 1102 Introduction to Computer Application Lab
3 Hours/Week, 1.5 Credits

Operating System: Windows - Students will learn the basics of computer, how to operate them in two basic environments, dos and Windows. **Word Processor:** Students will learn to use a popular word processor to create a camera ready test file complete with figures, columns and tables. **Spread Sheet:** Students will learn to use a popular Spread Sheet to maintain a small data base, minor book keeping and statistical and graphical analysis of data. **Presentation package:** Students will learn how to create multimedia slides and animation.

CSTE 1103 Fundamentals of Electrical and Mechanical Engineering
3 Hours/Week, 3 Credits

Electrical engineering:
Introduction to Electrical Circuit, **D. C. Generator:** Introduction, construction, EMF equation, classification, Total loss, Armature reaction & commutation, Characteristics; **D. C. Motor:** Introduction, construction, speed & Torque equation, classification, Characteristics, starting and speed control of d.c. motors. **Transformer:** Introduction, construction, EMF equation, classification, Total loss, Open circuit and Short circuit test. **Induction motor (single & three phase) & Synchronous motor:** Introduction, Construction, Starting, Application. **Stepper motor:** Operation, Application; **Switchgear:** Switch, Fuse, Circuit Breaker, Relay;
Electronic Engineering:
Theory of Semiconductors: Electronic structure of the elements. Energy band diagram of Insulator, semiconductor & metal. **Semiconductor Diodes:** The pn junction. Junction biasing conditions. Effect of asymmetric doping. I-V characteristics. Dynamic and static resistance of diode. Half wave and Full wave rectification & filtering. Clipping and clamping circuits. Voltage regulators. voltage doubler and voltage multiplier. Junction capacitance and Varactor diode. Avaalanche and Zener breakdown. Zener and Tunnel diodes. **Integrated Circuits:** Introduction, Advantage, Drawback, Scale of Integration, Classification by structure and function, How IC are made?
Mechanical Engineering: Basic law of Thermodynamics and Fluid Mechanics.

PHYS 1101 Electromagnetism, Oscillations and Optics
3 Hours/Week, 3 Credits

Electromagnetism: Coulomb's Law; Electric field; Gauss's Law and its application; Electric potential; Capacitors and capacitance: Capacitors with dielectrics, Dielectrics an atomic view, Charging and discharging of a capacitor; Magnetic

field: Magnetic induction, Magnetic force on a current carrying conductor, Torque on a current carrying loop, Hall effect; Faraday's Law of electromagnetic induction; Lenz's Law; Self induction; Mutual induction; Magnetic properties of matter: Hysteresis curve; Maxwell equations.

Simple Harmonic Motion: Differential equation of a Simple harmonic oscillator, Total energy and average energy, Combination of simple harmonic oscillations, Lissajous' figures, spring- mass system, Time period of torsional pendulum; Damped oscillation: Determination of damping co-efficient; Forced oscillation: Resonance, Two-body oscillations, Reduced mass, Differential equation of a progressive wave, Power and intensity of wave motion; Stationary wave: Group velocity and phase velocity; Doppler effect.

Theories of light: Interference of light, Young's double slit experiment, Fresnel Bi-prism, Interference at wedge shaped films, Newton's rings, Interferometer; Diffraction of light: Fresnel and Fraunhofer diffractions, 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, Malus Law, Polarization by double refraction, Retardation plates, Nicol prism, Optical activity, Polarimeters, Polartoids.

PHYS 1102 Physics Lab

3 Hours/Week, 1.5 Credits

1. Determination of unknown resistances and verification of the laws of resistances by P.O Box. Apparatus: Post Office Box, Galvanometer, Unknown resistances, Resistance, Connecting wires, Key, etc.
2. Comperison of EMF of two Cells. Apparatus: Galvanometer, Potentiometer, Two cells, Battery, 6V, Connecting wires, Rheostat, 3 way key, etc.
3. Determination of the thermal conductivity of a bad conductor by Lee's method. Apparatus: Lec's and Chorlton's apparatus, Slide Callipers, Thermometers, Watch, Stands and Clamps, Rubber tubes, etc.
4. Determination of mechanical equivalent of heat by electrical method. Apparatus: Joule's calorimeter, Voltmeter, Ammeter, Thermometer, Stopwatch, Connecting wires, balance, Stand and clamp, etc.
5. Determination of the focal length of i. a convex lens by displacement method and ii. a concave lens by an auxiliary lens method. Apparatus: Optical bench, Convex lens, Concave lens, Screen, Index rod, Lamp, meter scale, etc.
6. Determination of the refractive index of a liquid by plane mirror and a pin method using a convex lens.Apparatus: A convex lens, Plane mirror, Pin, Spherometer, Slide Callipers, Stands and clamp, Liquid, Water, etc.
7. Measurement of the refractive index of the material of a prism with the help of a spectrometer. Apparatus: Spectrometer, Prism, sodium lamp arrangement, Spirit level, etc.
8. Determination of the radius of curvature of a plenoconvex lens by Newton's method.Apparatus: Newton's Ring apparatus, Sodium lamp, Glass side, Stands and Clamps, etc.]

MATH 1101 Differential and Integral Calculus

2 Hours/Week, 2 Credits

Differential Calculus: Limits, continuity and differentiability; Successive differentiation of various types of functions; Leibnitz's Theorem; Rolle's Theorem; Mean value Theorem; Expansion of functions; Evaluation of indeterminate forms by L'Hospitals rule; Partial differentiation; Euler's Theorem; Tangent and Normal; Maximum and minimum values of functions of single variable; Curvature, Asymptotes.

Integral Calculus: Definitions of integration; Integration by the method of substitutions; Integration by parts; Standard integrals; Integration by the method of successive reduction; Definite integrals and its use in summing series; Walli's formula, Improper integrals, Beta function and Gamma function; Area under a plane curve; Area of the region enclosed by two curves; Volume of solids of revolution; multiple integrals and its application.

FENG 1101 Developing Basic English Skills
2 Hours/Week, 2 Credits

Listening: Listening for comprehension, listening for general information, listening for specific information, listening for gist of details, listening for note taking. **Speaking:** Speaking in different contexts: everyday life, academic and business situations; different modes of interaction: free conversation, group discussion, debate, public speaking, formal and informal presentation, seminar presentation; useful language functions: definition, description, narration, instruction, explanation, circumlocution, exemplification, argumentation, generalization & specification, cause and effect. **Reading:** Reading strategies: skimming, scanning, predicting, inferring; receptive reading, reflective reading, extensive reading, intensive reading, reading for note taking and research, reading for vocabulary development, sense of a text: syntactic knowledge, morphological knowledge, general world knowledge, socio-cultural knowledge, topic knowledge, genre knowledge; reading passages for comprehension, reading selected stories written by some classic writers. **Writing:** Some grammatical problems: tense, article, preposition; phrase, clause; structure of sentences: simple, complex, compound; subject-verb agreement, conditionals. Discursive and creative writing: using different writing strategies: description, narration, cause and effect, classification and division, exemplification, argumentation and persuasion. Tasks: paragraph and essay writing, journal writing, self and peer editing, note taking.

HUM 1101 Financial and Cost Accounting
3 Hours/Week, 3 Credits

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 technique; 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.

Year-1 Term-2

CSTE 1201 Structured Programming Language
3 Hours/Week, 3 Credits

Programming Language: Basic concept, Overview of programming languages, Problem Solving Techniques and Data Flow Diagram. **C-Language: Unit I:** Programming Language 'C': Variables, Datatypes, Declarations, Operators, Expressions, Input Output Operations, Formatted I/O, Hierarchy of Operations, Decision Making, The While, The For, The Do While Loops, Nesting of loops, Switch, Continue, Break statements, Jumps in loops, GoTo statements. **Unit II:** Defining & Using Functions, Parameter Passing, Recursion, Pointers, Pointers to functions, Global, Static, local variables, Command Line Arguments. **Unit III:** Array variables, syntax. rules for arrays, Multiple subscripts in arrays, reading & writing multidimensional arrays Pointers & Arrays, Array of Pointers, Manipulation in array, String Handling. **Unit IV:** Using Structures, Structures in arrays, arrays in structures, Pointers for structure, pointer to pointer, Enumerated Data Type, Union, Preprocessor, Macros, and Compilers controlled Directives. **Unit V:** File Management, Sequential files, unformatted files, Text Files, Binary Files, and Bitwise Operators. Graphics Programming Lines, Drawing & Filling images, Patterns, Drawing & Filling Shapes, Palettes & Colors, Text in Graphics.

CSTE 1202 Structured Programming Language Lab
3 Hours/Week, 1.5 Credits

Laboratory works based on CSTE 1201

CSTE 1203 DISCRETE MATHEMATICS
3 Hours/Week, 3.0 credits

Numbers, Functions and Counting : Integers. Definition and proof by induction. Functions on finite sets. Divisibility. Eucildean algorithm. Exclusion inclusion principle. Euler's Function. Binomial coefficients. Designs, t-designs. Permutation. Modular arithmetic and Euler's theorem. Examples and use of recurrence relations and generating functions in counting problems. **Graphs, Trees, Digraphs, Networks and flows:** graphs and their isomorphism. Valencey. Paths and cycles. Trees. Colouring the vertices of a graph. Counting the leaves on a rooted tree. Spanning trees and the MST Problems. Bipartite graphs and matching problems. Transversals for families of finite sets. Diagraphs, Networks and flows. The max -flow and min-cut theorem. **Finite Geometries :** Cryptology and coding theory, Review of the theory of the finite fields. Finite fields and Latin Squares. Finite geometry and designs. Finite projective planes. Steinear triple systems. Basic ideas of public key cryptology and the theory of error correcting codes. Hamming code. **Random Variables and Stochastic Processes:** Random variables, Functions of random variables, Sequences of random variables, Stochastic processes, Markov chains, Markov processes and queuing theory.

CSTE 1205 ELECTRIC CIRCUIT ANALYSIS
3 Hours/Week, 3 Credits

Circuit Models: Characteristics & applications of linear circuit elements, Ideal and non-ideal sources : Voltage and Current. Series, Parallel and Compound circuit analysis. Loading effects: Ammeter and Voltmeter. **Circuit Theorem and DC analysis:** Ohm's law, Voltage and current divider rule, Kirchhoff's Laws. Superposition Theorem. Thevenin's Theorem. Norton's Theorem. Maximum Power Transfer Theorem. Reciprocity Theorem. Mesh and Nodal analysis. Matrix form of Mesh and Nodal equations. Use of Cramer's rule. Bridge networks. T-Pie and Pie-T Conversions. **Transients and Time Domain analysis:** Transient in RC, RL, and RLC circuits. Pulse repetition rate and duty cycle. Average value. RC response to a square wave inputs. **A. C. Circuits:** Periodic functions, average & rms values, Steady state behavior with sinusoidal, excitation, phasor representation, reactance and impedance, series and parallel a.c. circuits, resonance, power in a.c. circuits, power factor, principle of generation of single phase & Three phase voltages. Power in Balanced three phase AC systems. **Networks:** Two port network and its parameters. Equivalent circuits. Analog filter design: Elementary filter theory, Characteristics impedance. Low pass filter, High pass filter, Band-pass filter, Band-elimination filter. **Coupled Circuits and Transformers:** Self and mutual inductance, Analysis of coupled circuits. Coefficient of coupling, Linear transformer, Ideal Transformer. **Magnetic Circuits:** Flux, mmf, reluctance, analogous electric circuits, simple calculations for composite magnetic circuits.

CSTE 1206 ELECTRIC CIRCUITS AND ANALYSIS LAB
1.5 Hours/Week, 0.75 Credits

Laboratory works based on CSTE 1205.

CSTE 1207 SEMICONDUCTOR DEVICES & CIRCUITS
3 Hours/Week, 3 Credits

Bipolar Transistors: Junction transistors. npn & pnp transistors. Principle of transistor action. Potential distribution through a transistor, Transistor current components, emitter efficiency, transport factor, large signal current gain. Transistor as an amplifier. Transistor characteristics in CB, CE & CC configurations. Large signal, dc, and small signal CE values of current gain. Concept of load lines. Dynamic transfer curves of Ge & Si transistor. Transistor switching

times. **BJT Biasing and Basic amplifier circuit:** The operating point. Capacitive coupling. The static and dynamic load lines. Bias stability. Thermal instability. Stability factor S. Analysis of different types of biasing circuits. Stabilization against variations in V_{BE} and beta for the self bias ckt. Bias-compensation and Thermal runaway. Classification of amplifier. BJT small signal amplifier circuit analysis in three configuration using different biasing circuit. Push-pull amplifier. **Transistor hybrid model:** Determination of h-parameters from the characteristics. **Oscillators:** Feedback and circuit requirements for oscillation. Nyquist's criterion. Sinusoidal oscillators. Barkhausen criterion. Phase-shift oscillators, resonant circuit oscillators, Colpitt's and Hartley's Oscillator, Wein bridge oscillator, crystal oscillator. Frequency stability. **Operational Amplifier:** Basic differential amplifier. Differential amplifier circuits. Differential amplifier with current mirror and active load. Differential amplifiers in ICs. Basics of operational amplifiers. The ideal OpAmp. Study of OpAmp parameters. OpAmp circuits. Active filters. Voltage regulation. Sample and hold circuit, phase-lock loop.
Field Effect Transistors: JFET: construction, operation, static characteristics, small signal model and parameters. MOSFET: different types, operation, characteristics curves. DC biasing of depletion and enhancement type MOSFET. Different biasing conditions of JFET. **Industrial electronics devices:** Thyristors, SCR, TRIAC, UJT, PUT, DIAC, Shockley diode. **Optoelectronics devices:** LED, Liquid Crystal displays (LCD) Photodiodes, Phototransistors, Opto-isolators, Solar cells.

CSTE 1208 SEMICONDUCTOR DEVICES & CIRCUITS LAB
1.5 Hours/Week, 0.75 Credits

Laboratory works based on CSTE 1207.

MATH 1203 Matrices, Ordinary and Partial Differential Equations
3 Hours/Week, 3 Credits

Matrices: Definition of matrix; Different types of matrices, Algebra of matrices, Adjoint and inverse of a matrix; Elementary transformations of matrices; Matrix polynomials; Caley-Hamilton theory with uses of rank and nullity; Normal and canonical forms; Eigen values and eigenvectors. Definition and properties of vector spaces, subspaces, basis and dimension, change of basis.
Ordinary Differential Equation, ODE: Degree and order of ordinary differential equations; Formation of differential equations; Solution of first order differential equations by various methods; Solution of first order but higher degree ODEs; Solution of general linear equations of second and higher orders with constant coefficients; Solution of homogeneous linear equations.
Partial Differential Equations, PDE: Rules for solving simultaneous equations of the form $\frac{dx}{P}=\frac{dy}{Q}=\frac{dz}{R}$; Integral surfaces passing through a given curve, Nonlinear PDE of order one, complete, particular, singular and general integrals: standard forms, Charpit's method; Second order PDE: its nomenclature and classifications. Linear PDE with constant coefficients.

HUM 1203 Industrial and Business Management
3 Hours/Week, 3 Credits

Introduction: Evolution of Scientific Management and Industrial Engineering. Functions of Management - Brief description of each function, System concept. **Types of Organization structures:** line, staff, functional, project and matrix organizations; Types of companies and their formation. **Personal Management:** Objectives and functions - Recruitment, Selection, Training and Induction concepts and Techniques. **Accounting and financial Management:** Principles of double entry-Preparation of Financial statements; Budget and budgetary control-Profit-Volume analysis. **Facilities Planning:** Factors to be considered in site selection, layout planning, plant layout, Systematic layout planning,

computerized layout planning techniques. Introduction to Material Handling Principles. **Work study**: Methods study and Time Measurement, Steps in methods improvement-Use of chart and diagrams. **Performance rating and Methods:** Types of Allowances, computation of basic time and Standard time - Examples. **Wages and Incentives:** System of Wage Incentive Plans, Job evaluation and Merit rating.
Industrial relations: Fatigue and methods of eliminating fatigue; Industrial disputes-Settlement Machinery-collective bargaining-Trade unions-Workers participation in Industries in Bangladeshi context. Labour welfare and social security-Industrial safety-Methods and Techniques. **Production Planning and Control**: Functions and Objectives-job, batch, mass and continuous production-Economic lot size, Routing, Scheduling, Dispatching and Follow up. Materials Management – Importance, Inventory, Types of systems, selective inventory control techniques. **Quality Engineering:** Quality control-Quality Vs. Cost concept, Control chart for variables and attributes- Introduction to ISO-9000 series (2000 version), ISO 14000 (2000 version) and Total Quality Management, Quality Information systems, Bench marking and Documentation. **Introduction to Marketing and its Environment:** marketing concept, marketing mix.

FENG 1203 English for Specific Purposes
2 Hours/Week, 2 Credits

Developing skills in genre based writing, developing vocabulary for discipline specific needs, discussion on discipline specific discourses in engineering, business correspondence: resumes, applications and employment letters; memorandum; notices, agenda and minutes; quotations, orders and tenders; sales letters; claim and adjustment letters; social correspondence; report writing: business reports, technical reports, research reports, research projects, press release, proof reading and editing.

CSTE 1210 Project Work and Seminar/Viva Voce
1.0 Credits

Based on Theory Courses and Seminar Presentation

Year-2 Term-1

CSTE 2101 Object Oriented Programming
3 Hours/Week, 3 Credits

Fundamentals of object-oriented Design: Data Abstraction, Encapsulation, classes, Inheritance and Polymorphism, class Hierarchies. Designing and object-oriented system; identifying the classes, Assigning Attributes and Behaviour, finding Relationship between classes, arranging classes into hierarchies: A design example. A first look at C++: Using streams for input and output. **C++ enhancements to C:** Default Function Arguments, Placement of variable declarations, the scope resolution operation, the "Const" Qualifier, overloaded functions, OODBMS. **References:** References as Aliases, references and pointers similarities and differences, references as function parameters, references as return values. **Introduction to classes:** Declaring and using classes, class members, creation and destruction of objects, accessing data members, returning a reference, "Const" objects and member function. Classes and dynamic memory allocation: New, delete operators, "this" pointer. Static members, friends, array of class objects. **Inheritance and polymorphism:** Derived class and base class, derived class constructors, overriding member functions, public and private inheritance, virtual functions, polymorphism, multiple inheritances, classes within classes. **Operator overloading:** Overloading unary operator, overloading binary operator, data conversion. Generic functions, generic classes. File processing – formatted – unformatted and random files. Microsoft foundation classes: Strings, data structure. **Templates and Lists:** Generic actions & types, function templates, class templates, sequential lists, virtual function nuances.

CSTE 2102 Object Oriented Programming Lab

3 Hours/Week, 1.5 Credits

Laboratory works based on CSTE 2101

CSTE 2103 DIGITAL LOGIC DESIGN
3 Hours/Week, 3 Credits

Boolean Algebra and Minimization: Introductory concept of number systems and codes. Boolean constants and variables, truth tables. Basic logic functions. Boolean expressions. Implementing circuits from Boolean expressions. Boolean theorems, DeMorgan's theorem. Sum-of-product and product-of-sum forms. Simplifying logic circuits, algebraic simplification, the Karnaugh map method, Quine-McCluskey design method. **Logic Gates and Combinational Circuits:** Different types of logic gates. Circuit design using NAND or NOR gates only. Alternate logic-gate representations. Designing combinatorial logic circuits. Exclusive OR and NOR circuits. Logic circuits with multiple outputs. Designing without a truth table. **Flip-flops:** SR, JK, D and T flipflops. The D latch. Master-slave FF. Flipflop applications. FF synchronization. Data storage and transfer. Frequency division and counting. One shot. **Arithmetic circuits:** Adder circuits. Carry propagation, carry look-ahead adder. IC parallel adder. The 2's complement addition and subtraction system. The BCD adder. Binary multiplier. **Counters and Registers:** Asynchronous cuonter: Ripple counters, counters with mod numbers$<2^n$, IC asynchronous counters, asynchronous down counter, propagation delay in ripple counters. Synchronous down and up/down counters. Decoding a counter. Decoding glitches. Cascading BCD counters. Shift-registers. Counter applications: frequency counter, digital clock. IC registers. **MSI Logic Circuits:** Decoders, BCD-to-decimal decoders, BCD-to-7-segment decoder/drivers. Encoders. Multiplexers and multiplexer applications. Demultiplexers. **Integrated-Circuit Logic Families:** Digital IC terminologies, TTL logic family, TTL series characteristics, open-collector TTL, tristate TTL, ECL family, MOS digital ICs, MOSFET, CMOS characteristics, CMOS tristate logic, TTL-CMOS-TTL interfacing. **Memory Devices:** Memory terminology, general memory operation, semiconductor memory technologies, different types of ROMs, semiconductor RAMs, static and dynamic RAMs, Magnetic bubble memory, CCD memory, **FPGA Concept**.

CSTE 2104 DIGITAL LOGIC DESIGN LAB
1.5 Hours/Week, 0.75 Credits

Laboratory works based on CSTE 2103.

CSTE 2105 Numerical Analysis
3 Hours/Week, 3 Credits

Numerical analysis: Computer Number Systems; Overflow and underflow; Approximation in numerical computation; Truncation and round off errors; Propagation and control of round off errors; Chopping and rounding off errors; Pitfalls (hazards) in numerical computations (ill conditioned and well conditioned problems). **Interpolation:** Lagrange's Interpolation, Newton's forward & backward Interpolation Formula. Extrapolation; Newton's Divided Difference Formula; Error; Problems. **Numerical Differentiation:** Use of Newton's forward and backward interpolation formula only. **Numerical Integration:** Trapezoidal formula (composite); Simson's 1/3rd formula (composite); Romberg Integration (statement only); Problems. **Numerical Solution of System of Linear Equations:** Gauss elimination method; Matrix Inversion; Operations Count; LU Factorization Method (Crout's Method); Gauss-Jordan Method; Gauss-Seidel Method; Sufficient Condition of Convergence. **Numerical Solution of Algebraic and Transcendental Equations:** Iteration Method; Bisection Method; Secant Method; Regula-Falsi Method; Newton-Raphson Method. **Numerical solution of Initial Value Problems of First Order Ordinary Differential Equations:** Taylor's Series Method; Euler's Method; Runge-Kutta Method (4th order); Modified Euler's Method and Adams-Moulton Method.

CSTE 2106 Numerical Analysis Lab

1.5 Hours/Week, 0.75 credits

Laboratory works based on CSTE 2105.

CSTE 2107 Introduction to Telecommunication
3 Hours/Week, 3 Credits

Introduction to Information Theory: Concept of amount of information, units- entropy, marginal, conditional and joint entropies - relation among entropies - mutual information, information rate. capacity of bandlimited gaussian channels, Shannon- Hartley theorem - bandwidth - SNR trade off -capacity of a channel of infinite bandwidth, Shannon's limit. **Overview of telecommunication:** history, evolution, convergence of telecommunication and data networks, standards; **Basics of communication systems:** modulation, multiplexing; **Switching systems:** circuit switching, packet switching; Voice over Internet Protocol, VoIP, Fax over IP network, voice over frame relay, and ATM; **Telephony:** operating principles, telephone apparatus, description of the modern phone; **Telephone switching systems:** PABX, Centrex, ACDs, call centers, computer integration; **Data communication equipment:** introduction to terminals, modems, RS-232 and other interfaces, modem types; Tele-Traffic analysis; **Modern Communication:** GSM, CDMA, Introduction to Satellite Communication, Optical fibre communication, Submarine cables and Digital Radio Microwave.

MATH 2105 Vector Analysis, Laplace Transform and Fourier analysis

3 Hours/Week, 3 Credits

Vector differentiation: Derivative of vector function-Velocity and acceleration-Scalar and vector fields-Gradient- It's geometrical interpretation-Directional derivative-Divergence and Curl-Their physical meaning-Relations involving-Solenoidal and irrotational fields-Scalar potentials (simple problems). **Vector Integration:** Line integral, surface integral and volume integral-work done by a force-Statement and Verification of Green's theorem, Stoke's theorem and Gauss's Divergence theorem-their use in evaluating the Integrals. **Laplace Transforms:** Definition; Laplace transforms of some elementary functions; Inverse Laplace transforms; Laplace transforms of derivatives. The unit step function; Periodic function; Some special theorems on Laplace transforms; Partial fraction; Solutions of differential equations by Laplace transforms; Evaluation of improper integrals. **Fourier analysis:** Real and complex form of Fourier series; Finite transform; Fourier Integral; Fourier transforms and their uses in solving boundary value problems of wave equations.

HUM 2105 Principle of Economics
3 Hours/Week, 3 Credits

Definition and scope of Economics: Definition of basic terms-Goods-wants and their classifications-wealth-Income – Money- -Near money- Credit money- Utility, features and kinds of utility – Concept of national income:-Methods of calculating GDP, GNP, NMP etc.at factor cost, at market prices etc. , Numerical problems on National income, Capital formation, savings and Investment relationship, Economic estimation. Bangladeshi economic growth in rates and their estimation. Bangladeshi economic growth in recent years, Saving investment equality, LM, IS curves. **Basic laws in Economics:** Law of Diminishing marginal utility – Demand, Law of Demand and demand curve- The concept of supply-Supply schedule and supply curve**. Market structure:** Classifications – Pricing under different markets as perfect competition, monopoly and oligopoly. Pricing under monopolistic competition. **Inflation:** Measures to control inflation – Monetary measures and fiscal measures – Effects of inflation. **Tax:** Classification of Taxes – Direct & Indirect taxes specific and AdValorem taxes – personal income- tax – characteristics of a good tax system – Tax evasion. **International Monetary Fund:** Issues & Challenges – International liquidity – Special Drawing Rights - Bangladesh & IMF. **Welfare Economics:** Old Welfare Economics -Pigou's Analysis – New Welfare Economics Pareto's welfare criterion**.**

Year-2 Term-2

CSTE 2201 Data Structure and Algorithms
3 Hours/Week, 3 Credits

Internal data representation: Abstract data types. Elementary data structures: arrays, lists, stacks, queues, trees, graphs; Advanced data Structures; heaps, Fibonacci heaps, B-trees; Recursion, sorting, searching, hashing, storage management.
Algorithm: Techniques for Analysis for Algorithms, Standard Efficient Techniques, Divide and Conquer, Greedy Method, Dynamic Programming, Back-Tracking, Branch and Bound, Basic Search and Traversal Techniques , Topological Sorting, Connected Components, Spanning Tree, Shortest Paths, Flow Algorithms, Approximation Algorithms, Graph Algorithms, Geometric Algorithms, Parallel Algorithms, Algebraic Simplification and Transformations, Lower Bound Theory, NP Completeness, NP hard and NP complete problems.

CSTE 2202 Data Structure and Algorithms Lab
3 Hours/Week, 1.5 credits

Laboratory works based on CSTE 2101.

CSTE 2203 Digital Electronics and Pulse Techniques
3 Hours/Week, 3 Credits

Diode logic gates, transistor switches, transistor gates, MOS gates; Logic Families: TTL, ECL, IIL and CMOS logic; Propagation delay, product and noise immunity; Open collector and high impedance gates; Electronic circuits for flip-flops, counters and register, memory systems, PLA's; A-D and D-A converters with applications; S-H circuits, LED, LCD, and optically coupled oscillators; Non-linear applications of OP AMPs; Analog switches.
Linear wave shaping: diode wave shaping techniques, clipping and clamping circuits, comparator circuits, switching circuits; Pulse transformers, pulse transmission, pulse generation; monostable, bistable and astable multivibrators, Schmitt trigger, blocking oscillators and time-base circuit; Timing circuits; Simple voltage sweeps, linear current sweeps.

CSTE 2204 Digital Electronics and Pulse Techniques Lab
1.5 Hours/Week, 0.75 credits

Laboratory works based on CSTE 2203.

CSTE 2205 Computer Architecture and Organization
3 Hours/Week, 3 Credits

Introduction: A brief history of computers, difference between computer architecture & organization, **Basics of computer organization:** structure of digital computer-CPU, ALU, I/O devices, Harvard & Neumann architecture. **Arithmetic & logic circuits:** Serial adder, Ripple carry adder, carry look-ahead adder, design of floating point adder, **Multiplier & divider:** Booths multiplier, array multiplier, restoring & nonrestoring divider. **Tri-state bus & Bus inter connection:** Register transfer & RTL notation. **ALU Design:** Combinational ALU & sequential ALU. **Instruction Set:** Instruction format, instruction types, CPI, MIPS & FLOPS, addressing modes of Instruction. **Memory organization:** memory technology, types of memory-volatile & nonvolatile, ROM, PROM, EPROM, EEPROM, Flash memory, SRAM, DRAM, SDRAM, Content addressable memory. Control Unit Design-hardwired control, microprogrammed

control, nanoprogram control. Pipeline control Unit-throughput & efficiency, instruction level pipelining different pipelined stages in CPU, pipeline hazards (data, control & structure). **Cache & virtual memory:** Direct, associative & set-associative , Cache miss & cache penalty, instruction cache & data cache, virtual memory paging. **CPU organization:** Fundamentals, Processor-memory communication with & without cache, overview of CPU functions, accumulator based CPU. **RISC & CISC based architecture:** Examples of RISC processor(SPARC & C490), introduction to superscalar & VLIW architectures. **I/O devices & system organization:** External devices(key boards, monitors, CD ROM drive , HDD, Mouse, light Pen etc.), I/O modules, programmed I/O, interrupt driven I/O. DMA-I/O processors, parallel processing. **Multiprocessors:** types, performance, single bus multiprocessors, multiprocessors connected by network, clusters.

CSTE 2206 Computer Architecture and Organization Lab
1.5 Hours/Week, 0.75 credits

Laboratory works based on CSTE 2205.

CSTE 2207 Object Oriented Programming in GUI Environment
3 Hours/Week, 3 Credits

Introduction to Java: History of Java**,** Java Class Libraries**,** Introduction to Java Programming**,** A simple Program**. Developing Java Application:** Introduction, Algorithms, Pseudo code, Control Structure, The If /Else Selection Structure, The While Repetition Structure, Assignment Operators, Increment and Decrement Operators, Primitive Data Types, Common Escape Sequence, Logical Operator. **Control Structure :** Introduction, The For Structure, The Switch Structure, The Do/While Structure, The Break and Continue Structure**. Methods:** Introduction, Program Module in Java, Math Class Methods, Method Definitions, Java API Packages, Automatic Variables, Recursion, Method Overloading, Method of the Applet Class**. Arrays :** Introduction, Arrays, Declaring and Allocating Arrays, Passing Arrays to Methods, Sorting Arrays, Searching Arrays, Multiple-Subscripted Arrays. **Object-Based Programming :** Introduction, Implementing a Time Abstract DataType with a Class, Class Scope, Controlling Access to Members, Utility Methods, Constructors, Using Overload Constructor, Using Set and Get Method, Software Reusability, Friendly Members, Finalizers, Static Class Members, Data Abstraction and Information Hiding. **Object-Oriented Programming**: Introduction, Superclasses and Subclasses, Protected Members, Using Constructor and Finalizers in Subclasses, Composition vs. Inheritance, Introduction to polymorphism, Dynamic method building, Final Methods and Classes, Abstract Superclasses and Concrete Classes**. String and Characters, Graphics, Exception Handling, Files and Stream, Java API, Utility Classes, 2D Graphics, GUI, Swing, Events.**

CSTE 2208 Object Oriented Programming in GUI Environment Lab
3 Hours/Week, 1.5 credits

Laboratory works based on CSTE 2204

CSTE 2209 Theory of Computation
3 Hours/Week, 3 Credits

Strings, Alphabet, Language, Operations, Finite. state machine, definitions. Finite automation model, Acceptance of strings and languages, Non Deterministic Finite Automation, Deterministic Finite Automation, Equivalence between NF A and DF A. Conversion of NFA into DFA, Minimization of FSM, Equivalence between two FSM's, Moore and Melay machines. Regular sets, Regular expressions, Identity rules, Manipulation of regular expressions, Equivalence between RE and FA. Inter conversion, Pumping lemma. Closure properties of regular sets (proofs not required). Regular grammars, Right linear and left linear grammars, Equivalence between regular linear grammar and F. A. inter conversion between RE and RG. Context free grammar, Derivation trees, Chomsky Normal. Form, Greibach Normal Form, Push Down Automata, Definition, Model, acceptance of CFL, Equivalence of CFL and PDA, Interconversion, enumeration of

properties of CFL (proofs omitted). **Turing Machine:** Definition, Model, Design of TM, Computable functions, Recursive ensumerable language, Church's hypothesis, Counter machine, Types of TM's (Proofs not required). Chomsky hierarchy of languages, Linear bounded automata and context sensitive language, Introduction of DCFL and DPDA LR(O), grammar, Decidability of problems. **Undecidability:** Properties of recursive & non-recursive enumerable languages, Universal Turing Machine, Post-correspondence problem .Introduction to recursive function theory.

MATH 2207 Complex Variable, Statistics and Probability
3 Hours/Week, 3 Credits

Complex Analysis-Differentiation: Differentiation of functions of complex variable-Analytic functions-Cauchy-Riemann Equations (cartesian only)-Harmonic function-Orthogonal system-velocity potential. **Conformal mapping-** Mapping by w=1/z,w=z2, w=ez, w=z+1/z, w=sinz, w=cosz. Bilenear Transformation-fixed points-Problems to find the transformation when three points and their images are given.
Complex Analysis-Integration: Line integrals-simple problems-Statements of Cauchy's integral theorem, Cauchy's integral formula-Formula for higher derivatives-Evaluation of integrals using the above results. Taylor series and Laurent's series (no proof)-simple problems. Singularities-Residues-Cauchy's Residue theorem (no proof)-problems. Evaluation of real definite integrals of the following types:
$\int_0^{2\pi} f(\sin\theta, \cos\theta)\, d\theta$ $\int_0^{\infty} [f(x)/F(x)]\, dx$ $\int_0^{\infty} [\sin mx/f(x)]\, dx$ $\int_0^{\infty} [\cos mx/f(x)]\, dx$
Probability and statistics: Random variable-continuous and discrete distribution-mean and variance. **Binomial distribution**-mean and variance-fitting a Binomial distribution-Problems. **Poisson distribution-**Poisson distribution as a limiting case of the Binomial distribution-mean and variance- Problems. **Normal distribution-**Properties-Problems. **Curve fitting-**Fitting of a straight line and a second degree parabola,by the method of least squares. **Testing of Hypothesis-**Types of errors-Null hypothesis-level of significance-Confidence limits-Large sample tests testing of proportion of attributes-confidence limits for unknown mean-test of significance for means of two large samples-Use of Student's t distribution for small sample tests-Significance test of a sample mean-Significance test of difference between sample means.

CSTE 2210 Project Work and Seminar/Viva Voce
1.0 Credits

Based on Theory Courses and Seminar Presentation

Year-3 Term-1

CSTE 3101 Electronic Communication
3 Hours/Week, 3 Credits

Introduction: Frequency spectrum of electromagnetic waves, their properties, wave propagation etc. Tuned Amplifiers, gain and bandwidth, neutralization, Noise types-its source, noise figure calculation.
Analog Modulation: AM modulators, series plate modulated class C amplifier, efficiency and power calculations, and SSB modulation SSS-SC modulations. A.M. Demodulators, square law detector, diode peak detector, envelope detector, detectors for SSB and SSB-SC AM signals, AM using transistors, Angle Modulation, Frequency modulation spectrum, Reactance tube and FET modulators Armstrong method, F.M. transmitters, frequency stabilization methods. FM discriminator, PLL detectors, .stereophonic FM. **Pulse Modulation:** Pulse modulation, pulse amplitude modulation (PAM), Pulse width Modulation (PWM), Pulse Position Modulation (PPM). Application of Pulse Communication.
Television systems: Some basics on television systems, television broadcast studio, principle of colour television, NTSC, SECAM, PAL system, propagation of television signals. **Line telephony:** Elementary phone System, central switching, simple exchange, two and four wire connections, Time division multiplexing, Analog Time division

switching, time slot interchanging (TSI), space array for digital signal, combined space time switching. Introduction to ISDN channels & access arrangements, formats, service capabilities and user-network interfaces; Limitations of ISDN, Introduction to B-ISDN. Introduction to cordless telephones, Digital PABX and WLL.

CSTE 3102 Electronic Communication Lab
1.5 Hours/Week, 0.75 credits

Laboratory works based on CSTE 3101.

CSTE 3103 Digital signal Processing
3 Hours/Week, 3 Credits

Discrete time signals & systems: Discrete time signals, Discrete time systems, Linearity, causality, stability, static/dynamic, Time Invariance/Time variance, classification of discrete time system, Linear convolution, Circular convolution Cross Correlation, Autocorrelation. Linear constant coefficient difference equations, sampling theorem & sampling process. Reconstruction of sampling data, convolution. Frequency domain representation of discrete time signals and systems, Fourier transform of discrete time signals, properties of discrete time, Fourier transform. **The Z-transform:** Definition, properties of the region of convergence for the Z-transform, Z-transform properties, Inverse Z-transform using contour integration, complex convolution theorem, Parseval's, unilateral Z-transform, stability interpretation using Jury's array. **Transform analysis of LTI system & structures for discrete-time system:** Frequency response of LTI system, relationship between magnitude & phase, all pass systems, minimum phase system. Linear system with generalized linear phase. Block diagram representation & signal flow graph representation of Linear constant. Coefficient difference equations, Basic structures for IIR systems, transposed forms, basic network structures for FIR systems, lattice structures.
Filter design Techniques: Design of discrete time IIR filters from continuous time filters, frequency transformations of low pass IIR filters, Design of FIR filters by windowing, FIR filter design by Kaiser window method. Frequency sampling method. **Discrete Fourier Transform:** Discrete Fourier series, properties of discrete Fourier series, Discrete Fourier transform, properties of DFT, circular convolution using discrete Fourier transform. Decimation in time FFT algorithm, decimation in frequency FFT, FFT of long sequences using overlap add and overlap save method. **Digital signal processor architectures:** Evolution of DSP architecture, different architectures, important architectural elements of a DSP, instruction set and special instructions, Introduction to interfacing DSPs.

CSTE 3104 Digital signal Processing Lab
1.5 Hours/Week, 0.75 credits

Laboratory works based on CSTE 3103.

CSTE 3105 Database Management Systems
3 Hours/Week, 3 Credits

Introduction: Drawback of general file processing system, data processing through COBOL, Basic concepts of database system, Architecture of a Database system, Data structures and Corresponding Operators. The Hierarchical Approach to DBMS: Architecture to IMS, IMS data structure, External Level to IMS, IMS, Data manipulation, defining PCB, DL/1, Operations, Construction SSA and SSA command codes, The Network Approach to DBMS : Architecture to DBTG Systems, DBTG data structures, Hierarchical and Network Set constructs, Singular Sets, Membership Classes and set selections. **Entity- Relationship Model :** Entities and Entity Sets, Relationships and Relationship Sets, attributes ,mapping constraints, keys, entity relationship diagrams reducing E-R diagrams to Tables, Generalization, Aggregation, Design of an E-R Database Scheme.
Relational Model: Structure of Relational Databases, The relational Algebra, The Tuple Relational Calculus, The domain Relational Calculus, Modifying the database, Views. **Relational Commercial Languages :** SQL, Query-by

Example, QUEL, Summary. **Integrity Constraints:** Domain Constraints, Referential Integrity, Functional Dependencies, Assertions and Triggers. **Relational Database Design :** Pitfalls in Relational Database Design, Normalization using Functional Dependencies. Normalization using Multivalued Dependencies, Normalization using Join Dependencies, Domain – Key Normal Form, Alternative Approaches to Database design. **Indexing and Hashing :** Basic Concepts, Indexing, B+ Tree Index Files, B- Index Files, Static Hash Functions, Comparison of Indexing and Hashing Index Definition in SQL, Multiple-Key Access. **Query Processing:** Query Interpretation, Equivalence of Expressions, Estimation of Query Processing Cost, Estimation of Cost of Access using Indices, Join Strategies, Join Strategies for Parallel Processors, Structure of a Query Optimizer. **Crash Recovery:** Failure Classification, The storage Hierarchy, Transaction Model, Log Based Recovery, Buffer Management, Checkpoints, Shadow Paging, failure With Loss of non-volatile Storage, Stable Storage Implementation.
Concurrency Control: Schedules, Testing of Serializability, Lock – based Protocols, Time Stamp Based Protocols, Validation Techniques, Multiple Granularity, Multi-version Schemes, Insert and Delete Operations.
Database System Architectures and Distributed Databases : Centralized Systems, Client/Server Systems, Parallel systems, Distributed data storage, Network transparency, Distributed query processing, Distributed transaction model, Commit Protocols, Concurrency controls, Deadlock handling, Multidatabase Systems.

CSTE 3106 Database Management Systems Lab
3 Hours/Week, 1.5 credits

Laboratory works based on CSTE 3105.

CSTE 3107 Operating Systems and System Programming
3 Hours/Week, 3 Credits

Introduction: What's an operating system, multiprogramming, time sharing, real time systems, multiprocessor system, and operating system services, operating system structures. **Process management:** Processes, Threads, Process Synchronization **CPU Scheduling:** Review of multiprogramming, concept, scheduling concept, scheduling algorithms, algorithm evaluation, multiple processor scheduling, disk and drum scheduling: Physical characteristics, first come first serve scheduling, shortest seek time first scheduling, SCAN, selecting a disk scheduling algorithm, sector queuing. **Deadlocks:** The deadlock problem, deadlock characterization, deadlock presentation, deadlock avoidance, combined approach to deadlock handling. **Memory management:** Preliminaries, swapping, multiple partition, paging, segmentations, and combined systems. Virtual memory: overlays, demand paging, performance of demand paging, page replacement, virtual memory concepts, page replacement algorithms, allocation algorithm, thrashing, other considerations. **File system:** file concept, access method, directory structure, mounting, file sharing, protection, file system implementation. **Protection:** goal of protection, mechanisms and policies, domain of protection, access matrix, implementation of access matrix, dynamic protection structures, revocation, Existing systems, and language based protection. **Security:** security problem, program threat, system and network threat, cryptography as a security tool, user authentication. **System Programming:** Introduction to System Programming and Linux / Unix, Shell Programming, C Language for System Programming, Make and Make files, Process and Signals, Threads, Inter process Communications, X- Window Programming, Principle of single and multi user operating systems.

CSTE 3108 Operating Systems and System Programming Lab
1.5 Hours/Week, 0.75 credits

Laboratory works based on CSTE 3107.

CSTE 3109 Microprocessor, Microcontroller and Interfacing
3 Hours/Week, 3 Credits

Introduction: Evolution of the Microprocessor, Microprocessor data types, Microcomputer hardware, Microcomputer addressing modes and instructions, System development flow chart, Typical Microprocessors & practical applications.

8086 Microprocessors: Introduction to 16 bit microprocessors, 8086/8088 CPU architecture, memory organization, interfacing addressing modes, Instruction set, programming examples, pseudo opcodes, assembler directives. 8086/88 maximum mode, 8087 architecture, 80386 architecture, real and protected mode. **Introduction to 8051 family architecture:** pin diagram, operation, ports, addressing modes, internal & external memory, SFR, flags, organization, counters and timers, serial communication. **Interfacing:** Basics of Keyboard and Display Interface, 8086 Keyboard Interface, DMA controllers, LRC7040 Printer Interface to a Microcomputer using the 8295 printer controller chip, Design the problem display scroller using the 8086.

CSTE 3110 Microprocessor, Microcontroller and Interfacing Lab
1.5 Hours/Week, 0.75 credits

Laboratory works based on CSTE 3109.

CSTE 3111 Electromagnetic Waves and Radiating Systems
3 Hours/Week, 3 Credits

Guided waves: Maxwell's equations; plane wave propagation in isotropic media; reflection; refraction; diffraction and polarization of WM waves; pointing vectors and power flow. Waves between parallel planes, TE, TM, TEM waves and their characteristics, Attenuation in parallel plane guides, wave impedances. **Rectangular waveguides:** TM, TE waves in rectangular guides and their characteristics, wave velocity, guide wavelength, wave impedances, field configurations. **Transmission lines:** Transmission line equations and their solution. Transmission line parameters, characteristic impedance, propagation constant, attenuation constant and phase constant, waveform distortion, distortionless transmission lines, loading of transmission lines, reflection coefficient and VSWR. Equivalent circuits of transmission lines, transmission lines at radio frequency, open and short circuited lines, smith chart, stub matching. **Potential:** Scalar and vector potentials, retarded potentials, field due to a current elements, power radiated and radiation resistance for field due to a dipole, power radiated and radiation resistance, reciprocity theorem applied to antennas gain and aperture of an antenna, radiation intensity, directivity and antenna gain. **Array:** Two element arrays and their directional characteristics, linear array analysis, broadside and end-fire arrays, pattern multiplication, binomial arrays, Design of broadcast array for a specific pattern. **Antenna:** Basic principles of parabolic reflectors, analysis and power pattern, lens antennas, folded dipole, turnstile and yagi antenna, log-periodic antennas, horn antennas, traveling wave antennas, cassegrain antenna.

Year-3 Term-2

CSTE 3201 Computer Networking
3 Hours/Week, 3 Credits

Introduction: The Use of Computer Network – Network Hardware, LANs, WANs, Wireless network, Internetworks, Network software Protocol Hierarchies, Design issues for Layers, Interfaces and services, CO & CL services, service primitives, relationship of services to protocol, OSI reference model, TCP/IP reference model, Example networks – Novell NetWare, Internet, X.25. **The physical Layer:** The theoretical basis of data communication-Fourier Analysis, Bandwidth-limited signals. The maximum data rate of a channel. Transmission Media – magnetic media, twisted pair, Baseband Coaxial Cable, Broad-band coaxial cable, fibre optics. Line of Sight transmission, Communication satellites. Analog Transmission, tree Telephone system, Modems, RS – 232 & RS – 449. **The medium Access Sublayer :** Local and Metropolitan Area's Networks Static Channel allocation in LAN's and MAN's Dynamic channel allocation in LAN's and MAN's Network Protocols-persistent and Non Persistent CSMA, CSMA with collision detection, BRAP-broadcast recognition with alternating priorities.MLMA-the multilevel multi-access Multi-access protocol, binary countdown. Limited Contention protocol – The adaptive tree walk protocol. IEEE standard 802 for local area network – IEEE standard 802.3 and Ethernet , IEEE standard 802.5 token bus,IEEE standard 802.5 token ,ring, comparison of local area networks, FDDI, Wireless LAN – 802.11. **The Data Link Layer:** data link layer issues-services provided to the network Layer, Framing Error Control, Flow control, Link Management, error detection and Correction-Error-Correcting

Codes, error-detecting codes. Elementary data link protocols – An Unrestricted simplex, Protocol, A simple Stop and wait protocol, A simplex protocol for a noisy channel, Sliding window protocols – A one bit sliding window protocol, A protocol using Go back N, A protocol using selective repeat Protocol performance – performance of the stop and wait protocol. Performance of the sliding window protocol. Example of the data link layer – the data layer in public networks – the data link layer in the Internet. **The Network layer:** Network Layer design issues – services provided to the transport layer, Internal organization of the network layer, Routing, Congestion, Internetworking, Routing Algorithms, Congestion – Control algorithms, Preallocation of buffers. Packet discarding, Isarithmic, Congestion Control, flow control, Choke packets, deadlocks. Examples of the network layer – the network layer in public networks, the network layer in Internet (IP). **The Transport Layer:** Transport layer design issues-services provided to the session layer, quality of services, the OSI transport service primitives, transport protocol, elements of transport protocols, addressing, establishing connection, releasing connection flow control & buffering, multiplexing, crash recovery, examples of transport layer, transmission Control Protocol TCP). **The presentation Layer:** Presentation layer design issues-Data representation, Text Compression, Network security and privacy. The OSI presentation, Service primitives, Substitution Ciphers, Transposition Ciphers, Public key Encryption, Secrecy and Digital Signature with Public Key encryption.

CSTE 3202 Computer Networking Lab
1.5 Hours/Week, 0.75 credits

Laboratory works based on CSTE 3201.

CSTE 3203 Microwave and Satellite Communication
3 Hours/Week, 3 Credits

Microwave Communication: CCIR recommendation on frequency assignment; comparison with radio communication in other frequency band; Microwave terminal and repeater stations; passive reflectors and repeaters; Fade margin and protection techniques such as hot stand-by and diversity reception; link budget calculation. **Microwave antennas;** Different types of antennas; basic performance analysis; Application. **Microwave transmission lines:** Introduction to transmission lines, waveguides, strip-lines, micro-strip lines, fin-lines, inverted-striplines. Reflection coefficient, Transmission coefficient, VSWR, Impedance transformation in RF lossless lines. Impedance measurement. Introduction to multi-port junctions: T-networks, Magic Tee, Directional couplers, Circulators. **Microwave Devices:** Microwave transistors; varacter diode, IMPATT diode, Gunn Diode, Schottky Barrier diode; backward diode; point contact diode; Klystron; Reflex Klystron, TWT and Magnetron. **Applications of Microwave:** Radar systems - Pulsed radar, MTI, Tracking radars, Altimeter- Principles of operation, applications.**Satellite Communication: Introduction:** Origin of Satellite communication. Current state of satellite Communication. **Orbital aspect of satellite communication:** Orbital mechanism, equation of orbit, locating satellite in orbit, orbital elements, orbital perturbation . **Space craft subsystem:-** Attitude and orbit control system, Telemetry tracking and command power system , communication subsystem. **Satellite link design:-** System noise temperature and G/T ratio, down link design, domestic satellite system, uplink design, design of satellite link for specified (C/N). **Fundamentals of Software Defined Radio:** Baseband Technology, Emergence of Software Defined Radio, Evolution of Software Defined Radio, Baseband requirements. **Multiple access techniques: -** FDMA, FDM/FM/FDMA, effects of intermodulation, companded FDM/FM/FDMA. TDMA, TDMA frame structure and design, TDMA synchronization and timing, code division multiple access, SS transmission and reception applicability of CDMA to commercial system, multiple access on board processing, SCPS system, digital speech interpolation system, DAMA.

CSTE 3204 Microwave and Satellite Communication Lab
1.5 Hours/Week, 0.75 credits

Laboratory works based on CSTE 3203.

CSTE 3205 WEB TECHNOLOGIES
3 Hours/Week, 3 Credits

Introduction: Basic tools of internet access, email ftp, news, WWW, anarchie, introduction to internet programming, sockets: connections, attributesm domains, types and protocols (sockets), creating and closing sockets, socket communication, client server application using C on Linux platform. **Standard:** Standard use for www documents on internet, HTTP,MIME,SGML, DTD. MTNL, URL, URI, HTML tags, special. characters. Images, table forms. (the hyperlinks. HTML URLs, serving HTML pages. **CGI :** CGI programming using C.
XML: XML basics, understanding markup languages, structures and syntax, valid Vr. well formed XML, DTD (document type Definition) classes. Scripting XML, XML processor- parent child relationship, XML as a data, data type in XML, XML namespaces, linking with XML: simple link, the HTML way. XSL: XML with style: style sheet basics, XSL basics, XSL style sheets.

CSTE 3206 WEB TECHNOLOGIES LAB
3 Hours/Week, 1.5 credits

Laboratory works based on CSTE 3205.

CSTE 3207 Digital Communication
3 Hours/Week, 3 Credits

Introduction: Analog and digital communication. Discrete signals. Elements of digital communication system. **Source encoding:** Pulse code modulation, quantization noise, linear and non-linear quantization, companding- A-law and μ-law. Differential pulse code modulation, delta modulation, and adaptive delta modulation**, Baseband transmission:** Baseband signal receiver: probability of error calculations, optimum filters, coherent reception, matched filter and its transfer function. Integrate and dump type filter. Regenerative repeater, Bit synchronization, Inphase and midphase synchronizer. Early late gate synchronizer. Frame synchronization. **Line coding:** Polar/Unipolar/Bipolar NRZ and RZ; Manchester, differential encoding and their spectral characteristic, self synchronization properties of some of the encoded signal. **Equalization:** Inter symbol interference (ISI), Purpose of equalization, Eye pattern, Nyquist criterion for zero ISI, fixed equalizer. Design of equalizer, Adaptive equalizer. **Digital modulation techniques:** ASK, FSK, BPSK, DPSK, M-Ary PSK, QPSK, MSK, GMSK, QAM, Error calculations. **Introduction to Coding Theory:** Compact codes, Instantaneous codes, Huffman code, Shanon-Fano code. Error control and correcting Codes; Linear block codes, Cyclic codes- BCH, Convolution codes
Coherent Binary: PSK, FSK, QPSK, MSK, GMSK, DPSK. **Multiplexing:** FDM, WDM, TDM, STDM, and Digital Subscriber Line**. Medium Access Control:** SDMA, FDMA, TDMA and CDMA. **Spread Spectrum methods:** Study of PN sequences, direct sequence methods, Frequency hop methods, digital spread spectrum, slow and fast frequency hop, performance analysis, synchronization methods for spread spectrum. Application of spread spectrum, CDMA.

CSTE 3208 Digital Communication Lab
1.5 Hours/Week, 0.75 credits

Laboratory works based on CSTE 3207.

CSTE 3209 Software Engineering and Information System Design
3 Hours/Week, 3 Credits

Introduction: Overview of Software Industry, Introduction to Software Engineering, Software Development Process and Various Life Cycle Models. **Requirement Analysis:** Communication Techniques, Analysis Principles, Software Prototyping, Requirement Specification. **Group Dynamics:** Working in Teams, Characteristics of Successful Team, Understanding Group Dynamics, Team Roles and Temperament, Democratic Team and Chief Programmer Team Approach. **Introduction to Extreme Programming**, **Analysis Modeling:** Steps of system analysis, Feasibility study, Economic and technical analysis, System specification, the elements of analysis model, Data modeling, Functional

modeling and information flow, Behavioral modeling, Mechanics of structured analysis, Data Dictionary. **Software Design:** Design principles, Design Concepts, effective modular design, design heuristics, Data Design, Architectural Design process, Transformation mapping, Transaction mapping, interface design, human-computer interface design, procedural design. **Software Testing:** Testing fundamentals, test case design, white-box testing, black-box testing, testing GUIs, Unit testing, Integration testing, validation testing, system testing, debugging. **Maintenance:** Major maintenance activities, estimating maintenance cost and productivity. **Technical Metrics for Software:** Software quality, Framework for technical metrics, metrics for analysis and design models, source code, testing and maintenance. **Software Architecture:** Pipe and Filter, Object Oriented, Event Based, Layered System, Data-centered repository, Process Control Architectures, **Objet Oriented Software Engineering**: O-O concepts, O-O analysis, Domain analysis, O-O analysis process, Object relational model. O-O design: system design process, object design process, O-O programming. **O-O Testing:** Testing strategies, test case design. **Software Project Management:** Cost estimation, risk analysis, project scheduling. **Introduction to CASE Tools:** What is CASE, taxonomy of CASE tools, iCASE environment, CASE repository, Example CASE tools. **Intellectual Properties:** Trade Marks, Copy Rights, Trade Secrets, Patents, **Introduction to UML**.

CSTE 3210 Software Engineering and Information System Design Lab
3 Hours/Week, 1.5 credits

Laboratory works based on CSTE 3209.

CSTE 3211 Wireless Communication and Networks
3 Hours/Week, 3 Credits

Communication networks: LANS, MANS & WANS; Switching techniques, ATM. **Protocol Architecture:** TCP / IP and OSI, internetworking. **Wireless communication Technology:** frequency planning, Noise and interference in wireless communication systems, Antenna & Radio-wave propagation in the mobile environment-fading, **Wireless LAN:** IEEE 802.11 standard, WLAN Family, WLAN transmission technology, WLAN system architecture, Collision Sense Multiple Access with Collision Detection(CSMA/CD) and CSMA Collision avoidance (CSMA/CA), 802.11 PHY and MAC layers, IEEE 802.11 Distributed Co-ordinate System (DCF) and Point Co-ordination Function (PCF), WLAN family, Wireless ATM. HIPERLAN: Requirements & Architecture. **BLUETOOTH:** Architecture & Protocol Stack. Brief overview of WiMAX for wireless broadband communication.

CSTE 3212 Wireless Communication and Networks Lab
1.5 Hours/Week, 0.75 credits

Laboratory works based on CSTE 3211.

CSTE 3214 Project Work and Seminar/Viva Voce
Based on Theory Courses and Seminar Presentation

Year-4 Term-1

CSTE 4101 Computer Graphics
3 Hours/Week, 3 Credits

Computer Graphics Programming: OpenGL. **Camera Analogy:** Viewing, Windowing, Clipping. **Projective Transformation(Ray-tracing):** Orthogonal Projection, Perspective Projection, **Vector:** Normal Vector, View Vector, **Matrix:** 2D and 3D Rotation and Translation Matrix, **Raster Graphics:** Line Drawing, Anti-aliasing, Polygon Filling Algorithms, **Hidden Surface Removal:** z-buffering, **Lighting and Surface Property:** Diffused Light, Ambient Light, Specular Light, Lighting Models for reflection, refraction and transparency, **Shading:** Flat Shading, Lambert Shading,

Phong Shading, **Texture Mapping:** Texture Fundamentals, Texture Blending, **Curves and Surfaces:** Types of Curves, Cubic-Spline, Beta-Spline, NURBS, **Animation:** Real time animation, Hardware for real-time animation, Character Animation, Computer Games, Movies**, Image Formats:** PPM, BMP, Image Based Rendering, **Morphing:** View-morphing, Volume Metamorphosis.

CSTE 4102 Computer Graphics Lab
1.5 Hours/Week, 0.75 credits

Laboratory works based on CSTE 4101.

CSTE 4103 Artificial Intelligence and Neural Networks
3 Hours/Week, 3 Credits

What is Artificial Intelligence: The AI problems, The underlying assumption, What is an AI technique. **Problems, Problem spaces and Search:** Defining the problem as a state space search, Production system, Problem characteristics. **Heuristics Search Techniques:** Generate and Test, Hill climbing, Best First Search, Problem Reduction, Constraint Satisfaction, Means-Ends Analysis. **Knowledge Representation Issues:** Representation and Mappings, Approaches to knowledge Representation, Issues in Knowledge representation. **Using Predicate logic:** Representing simple facts in logic, Representing Instance and Isa relationships, Computable functions and Predicates, Resolution. **Representing Knowledge using Rules:** Procedural versus Declarative Knowledge, Logic Programming, Forward versus Backward Reasoning, Matching. **Game playing:** Overview, The Mimimax Search Procedure, Adding Alpha-Beta cutoffs, Additional refinements, iterative Deepening, **Planning:** Overview, An example Domain: The Blocks World, Components of a planning system, Goal stack planning, **Uncertainty:** probability theory, Bayesian networks, certainty factors methods, basics of fuzzy logic, nonmonotonic reasoning systems. **Natural Language Processing:** Introduction, Syntactic Processing, Semantic Analysis, Discourse and Pragmatic Processing. **Expert systems:** representing and using domain knowledge, Expert system shells explanation, Knowledge Acquisition. **AI Programming Language**: Prolog, LISP. **Neural Network:** Fundamental concepts of artificial Neural Network (ANN), Model of ANN, Learning and adaptation learning rules. Feed forward Networks: Classification Model, features and decision, regions, Minimum distance classification, perceptron, Delta learning rules for multiperceptron layer, generalized learning rules, back propagation Algorithm; back propagation training, learning factors.

CSTE 4104 Artificial Intelligence and Neural Networks Lab
1.5 Hours/Week, 0.75 credits

Laboratory works based on CSTE 4103.

CSTE 4105 Optical Fiber Communication
3 Hours/Week, 3 Credits

Introduction: Optical transmission system concepts, optical networking, Optical interconnects, Optical computers, transmitting light on a fiber, light propagation in multimode fibers single mode fiber properties and characteristics, plastic optical fiber, HPCF, technology of fiber manufacture, joining fibers, fiber cables. **Optical sources and detectors:** light production, LEDs, characteristics, lasers, DFB lasers, tunable DBR lasers, photoconductors, photodiodes, and phototransistors. **Optical devices:** EDFAs, II generation EDFAs, Pr and Nd doped fiber amplifiers, plastic fiber amplifiers, erbium doped planar devices, SOAs/SLAs, Raman effect amplifiers. **Optical Communication System:** point to point transmission systems, modulation, transmission system limits and characteristics, optical systems engineering, control of dispersion in SM and MM fiber links, fiber optics in different environments, test equipment and techniques. Solitons, dark solitons and spatial solitons. **Optical link connections in electronic networks:** FDDI, Ethernet, fiber channel, ESCON and intersystem coupling, Opticonnect, SONET and SDH, ATM, WDM, building photonic networks, components for WDM, add drop multiplexers, optical space division switches, optical switching nodes, wavelength converters, standards for WDM, light wave networks.

CSTE 4106 Optical Fiber Communication Lab
1.5 Hours/Week, 0.75 credits

Laboratory works based on CSTE 4105.

CSTE 4107 Cellular Mobile System and Network Management
3 Hours/Week, 3 Credits

Fundamentals of cellular telephony: Concept of cellular communications, frequency reuse, cell splitting, registration, terminal authentication, handoff; **GSM and GPRS:** services, system architecture, radio interface, protocols, handover, security; 2.5G systems, EDGE, TETRA, 3G systems, UMTS, UTRAN, 4G and beyond; **CDMA:** IS-95 System architecture, Air interface, Physical and Logical channel, Handover and Security, and Introduction to CDMA 2000. **Network Management System:** Defines and explains techniques that network managers utilize to maintain and improve performance of telecommunications network; network management system; five tasks traditionally involved with network management (fault management, configuration management, performance management, security management, and accounting management); theoretical background in transmission systems sufficient to understand network parameters such as capacity and response times; and specific network management products. Also explores how network performance data should be used for management and when considering upgrades in network architecture. Web based NM (Introduction), WAS frameworks (HP OpenView, IBM Netview, SUN Solaris Enterprise Manager).

CSTE 4109 Compiler Construction
3 Hours/Week, 3 Credits

Introduction: Compilers & Translators, Structure of Compiler, phases of Compiler, Compiler writing tools, Programming languages: Lexical & Syntactic structure of a Language, Data elements, Data structures, Operators, Assignments, Program Units, Data environments. Parameter transmission, storage Management, Lexical Analyzer.
Syntax Analysis: The role of Parser, Top-down parsing, predictive Parsers. Bottom-up parsing. L.R. Parsers (SLR, CLR & LALR), Implementation of LR Parsers. **Syntax Directed Translation:** Intermediate Code, Postfix notation, Parse tree and Syntax Trees, Three address codes, quadruples, triples, Translation of Assignment statements. Boolean expressions, statements that alter the flow of control. Array references in arithmetic expressions, Procedure Calls, Declarations, and Case Statements. **Symbol Tables:** Contents, Data structures for symbol tables, representing scope information. Error detection and Recovery: Error handling. Lexical-phase, Syntactic phase and semantic phase. **Code Generation :** Issues in Code Generation, Target Machine, Runtime storage management, Basic block and flow graphs, Simple code generator, register allocation and assignment, DAG, Peephole Optimization, Generation Code from DAG's .**Code optimization:** Principle source of optimization, optimization of basic books, blocks, loops in Flow graphs, Data-Flow analysis, code improving transformations, alias, Data flow algorithms.

CSTE 4110 Compiler Construction Lab
1.5 Hours/Week, 0.75 credits

Laboratory works based on CSTE 4109.

CSTE 4111Project and Thesis
3 Hours/Week, 0.75 credits

Project work based on all major courses.

CSTE 4112 Industrial Training
0.75 Credits

4 weeks Industrial Training during the end of the semester vacation

Year-4 Term-2

CSTE 4201 Client Server Technology
3 Hours/Week, 3 Credits

Introduction, components of client server architecture, middleware, socket, Remote Procedure Call, RPC, Distributed Computing Environment, DCE, Common Object Request Broker Architecture, CORBA, Java Remote Method Invocation, RMI, Enterprise Java Beans, EJB, distributed data management, client server application development, storage management, security and user management, backup and recovery, performance tuning.

CSTE 4202 Client Server Technology Lab
3.0 Hours/Week, 1.5 credits

Laboratory works based on CSTE 4201.

CSTE 4201 Digital Image Processing
3 Hours/Week, 3.0 Credits

Digital Image Fundamentals: Digital Image Fundamentals, A Simple Image Model, Sampling and Quantization, Basic Relationship between Pixels, Image Geometry. **Image Transform:** Introduction to the Fourier Transform, The Discrete Fourier Transform, Properties of 2D Fourier Transform, The Fast Fourier Transform, Other Separable Image Transform. **Image Enhancement:** Background, Enhancement by Point-Processing, Spatial Filtering, Enhancement in Frequency Domain, Color Image Processing. **Image Restoration:** Degradation Model, Diagonalization of Circulant and Block-Circulant Matrices, Algebraic Approach to Restoration, Inverse Filtering, Geometric Transformation. **Morphological Image and Signal Processing:** The principle of Mathematical Morphology, Erosion and Dilation in the Euclidean Space, Closings and Openings, Grayscale Morphology, Links between Links and Sets, Grayscale Morphological Transformations, **Image Segmentation:** Detection of Discontinuities, Edge Linking and Boundary Detection, Thresholding, Region-Oriented Segmentation, The use of Motion in Segmentation. **Image compression:** run-length coding, transform coding, standards.

CSTE 4202 Digital Image Processing Lab
3.0 Hours/Week, 1.5 credits

Laboratory works based on CSTE 4201.

CSTE 4203 Multimedia Communication
3 Hours/Week, 3 Credits

Introduction to Multimedia: Media and Data streams Medium: The perception Medium. The representation medium. The presentation Medium, The storage medium, The information Exchange Medium, Representation values and representation spaces. Representation dimensions Main properties of Multimedia System: Multimedia System definition, Combination of Media, Independence, Computer Supported Integration, Communication systems Traditional Data Streams characteristics: Asynchronous Transmission mode Synchronous Transmission mode, Isochronous Transmission mode. **Sound / Audio / Images and Graphics :** Basic Sound Concepts, Computer Representation of sound, Audio formats Music:MIDI Basic Concepts, MIDI Devices, MIDI Messages, MIDI and SMPTE Timing Standards, MIDI Software Speech Generation, Speech Analysis, Speech Transmission Images and Graphics: Basic Concepts, Digital Image Representation, Image format. Graphics format. Computer image processing, Image syntesis, Image analysis. Image transmission. **Video and Animation:** Video Signal Representation, Computer Video Format, Television

Conventional system, Enhanced Definition Systems, High Definition Systems, Transmission. Computer based Animation, Animation Language, Methods of controlling Animation, Display of Animation, Transmission of Animation. **Data compression:** Storage space, Coding requirements, Source, Entropy and Hybrid techniques JPEG Image presentation. Lossy Sequential DCT – based Mode, Expanded Lossy DCT – based Mode Lossless Mode, Hierarchical Mode H.261 (px64) Image preparation. Coding Algorithms, data streams MPEG video encoding, Audio Encoding, Data Stream DVI and still Image Encoding, Video Encoding, Data Stream. **Multimedia Operating System Introduction:** Real Time and multimedia Resource management. Resources, Requirement, Component and phases, Allocation scheme, Continuous media Resource model process Management Real Time Process Management in conventional operation system Real Time Processing requirement, Traditional Real Time Scheduling, Traditional Real Time Scheduling: System model Earliest Deadline First Algorithm Rate Monotonic Algorithm EDF and Rate Monotonic: Context switches, EDF and approaches for In-Time Scheduling, Preemptive versus Non-Preemptive Task Scheduling, File Systems, Additional Operating System Issue, System Architecture. Multimedia Communication Systems and Database Systems Application Subsystem Collaborative Computing, Session Management Transport Subsystem: Requirements, Transport Layer, Network layer quality of Service and Resource Management Basic Concepts, Establishment and closing of the Multimedia Call Management Resources during Multimedia Transmission, Architectural Issue Multimedia Database Management System Characteristics of an MDBMS, Data analysis. Operation on Data, Integration in database Model.

CSTE 4205 Cryptography and Network Security
3 Hours/Week, 3 Credits

Overview of Cryptography: Concept of Cryptography, Symmetric Cryptosystem, Asymmetric Cryptosystem, Basic Terminologies, OSI Security Architecture, Network Security Model. **Symmetric Cipher Models:** Substitution Techniques, Transposition Techniques, Rotor Machines, Steganography, Block Ciphers & DES: Block Cipher Principals, The Feistel Cipher, Shannon's S-P Networks, Data Encryption Std.(DES) – DES Encryption, DES Decryption, The Strength of DES, Differential And Linear Cryptanalysis of DES; Block Cipher Design Principles. AES: Basic Structure, Primitive Operation, Inverse Cipher, Key Expansion, Rounds, Inverse Rounds, Simplified AES. **Public Key Cryptography and Hash Functions:** Principles of Public Key Cryptosystems, RSA Algorithms, Key Management, Diffie-Hellman Key Exchange, Elliptic Curve Cryptography, Authentication Requirements, Authentication Functions, Message Authentication Codes, Hash Functions, Security of Hash Functions And MACS Digital Signatures, Authentication Protocols, Digital Signature Standard. **Network Security:** Electronic Mail Security: Pretty Good Privacy, S/MIME. **IP Security:** Architecture, Authentication Header, Encapsulating Security Payload, Combining Security Associations, Key Management, Web Security: Web Security Considerations, Secure Socket Layer and Transport Layer Security, Electronic Translation. Firewalls: Firewall Design Principles, Packet-Filtering Router, Application-Level Gateway, Circuit-Level Gateway, Firewall Configurations, Trusted Systems.

CSTE 4207 Advanced Wireless Communication
3 Hours/Week, 3 Credits

Internet Service over wireless network: IEEE 802.16 and ETSI HIPERACCESS standards; Issues and challenges in extending internet services over wireless networks; Mobile IP; TCP over wireless; Wireless application protocol; Optimizing Web over wireless. **Ad hoc wireless networks:** Issues and challenges in infrastructure-less networks; MAC protocols; Routing protocols; Multicast routing protocols; Transport and security protocols; Quality of service provisioning; Energy management. **Hybrid wireless networks and wireless sensor networks:** Architectures and routing protocols for hybrid wireless networks; Load balancing schemes; Pricing schemes for multihop wireless networks; Issues and challenges in wireless sensor networks: Architectures and routing protocols; MAC protocols; Data dissemination, data gathering, and data fusion; Quality of a sensor network; Real-time traffic support and security protocols. Recent advances in wireless networks Wide Band (UWB) communication; Issues and challenges in UWB communication; Applications of UWB communication; Wireless Fidelity (Wi-Fi) systems; Issues in Wi-Fi Systems; Pricing/billing in Wi-Fi systems; Multimode 802.11; Optical wireless communications; Optical Wireless Wavelength Division Multiplexing (OWWDM), Mobile-Fi, WPAN.

CSTE 4208 Project and Thesis
3 Hours/Week, 3credits

Project work based on all major courses.

CSTE 4210 Viva Voce
1.0 Credits

Based on all theory courses.