Department of Computer Science and Engineering
Faculty of Engineering and Technology
Islamic University, Bangladesh

Syllabus for B.Sc. (Engineering) Courses
Session: 2018 – 2019,   Final Examination: 2022

Distribution of Courses

First Year : Semester I			
Course No.	**Course Title**	**Marks**	**Credit**
CSE 1101	Introduction to Computer Systems	100	3.00
CSE 1102	Introduction to Computer Systems Lab	50	1.00
CSE 1103	Structured Programming Language	100	3.00
CSE 1104	Structured Programming Language Lab	50	1.50
EEE 1105	Fundamental of Electrical Engineering	100	3.00
EEE 1106	Fundamental of Electrical Engineering Lab	50	1.50
HUM 1107	Communicative English	100	1.00
HUM 1108	Communicative English Skills Lab	50	1.00
MATH 1109	Algebra and Trigonometry	100	3.00
	Total	700	18.00
NCC	Islamic Studies / Bangladesh Studies*	100	
* Muslim Students have to take Islamic studies and non-Muslim/ Madrasa students have to take Bangladesh studies			

First Year : Semester II			
Course No.	**Course Title**	**Marks**	**Credit**
CSE 1201	Data Structures	100	2.00
CSE 1202	Data Structures Lab	50	1.00
EEE 1203	Electronics Devices and Circuits	100	3.00
EEE 1204	Electronics Devices and Circuits Lab	50	1.00
CSE 1205	Object Oriented Programming	100	3.00
CSE 1206	Object Oriented Programming Lab	50	1.50
PHY 1207	Physics	100	3.00
PHY 1208	Physics Lab	50	1.00
MATH 1209	Calculus and Differential Equations	100	3.00
CSE 1210	Viva Voce	50	1.00
	Total	750	19.00

Second Year : Semester I			
Course No.	**Course Title**	**Marks**	**Credit**
CSE 2101	Discrete Mathematics	100	2.0

Second Year : Semester I			
Course No.	Course Title	Marks	Credit
CSE 2102	Discrete Mathematics Lab	50	1.0
CSE 2103	Algorithms	100	3.0
CSE 2104	Algorithm Lab	50	1.0
CSE 2105	Digital System	100	3.0
CSE 2106	Digital System Lab	50	1.0
HUM 2107	Economics, Government and Sociology	100	2.0
MATH 2109	Geometry and Vector Analysis	100	3.0
CHEM 2110	Chemistry	100	3.0
	Total	750	19.0

Second Year : Semester II			
Course No.	Course Title	Marks	Credit
CSE 2201	Computer Architecture and Organization	100	3.0
CSE 2202	Computer Architecture and Organization Lab	50	1.0
EEE 2203	Switching Devices and Pulse Techniques	100	2.0
EEE 2204	Switching Devices and Pulse Techniques Lab	50	1.0
CSE 2205	Web Programming	100	3.0
CSE 2206	Web Programming Lab	100	1.0
CSE 2207	Numerical Methods	100	2.0
STAT 2209	Statistics for Engineers	100	3.0
STAT 2210	Statistics for Engineers Lab	50	1.0
HUM 2211	Business and Communication Law	50	1.0
ME 2212	Engineering Drawing	50	1.0
CSE 2214	Viva Voce	50	1.0
	Total	850	20.0

Third Year : Semester I			
Course No.	Course Title	Marks	Credit
CSE 3101	Database Management Systems	100	3.0
CSE 3102	Database Management Systems Lab	50	1.5
CSE 3103	Operating systems	100	3.0
CSE 3104	Operating systems Lab	50	1.5
CSE 3105	Microprocessors and Embedded System	100	3.0
CSE 3106	Microprocessors and Embedded System Lab	50	1.0
CSE 3107	Computer Network	100	3.0
CSE 3108	Computer Network Lab	50	1.5
MATH 3109	Complex analysis, Laplace and Fourier Transforms	100	3.0
HUM 3110	Technical Writing and Presentation	100	1.0
	Total	800	21.5

Third Year : Semester II			
Course No.	Course Title	Marks	Credit
CSE 3201	Computer Graphics	100	3.0
CSE 3202	Computer Graphics Lab	50	1.0

Third Year : Semester II			
Course No.	Course Title	Marks	Credit
CSE 3203	Computer Peripherals and Interfacing	100	3.0
CSE 3204	Computer Peripherals and Interfacing Lab	50	1.0
CSE 3205	System Analysis and Design	100	2.0
CSE 3206	System Analysis and Design Lab	50	1.0
CSE 3207	Theory of Computation	100	2.0
CSE 3208	Theory of Computation Lab	50	1.0
CSE 3209	Multimedia Engineering	100	3.0
CSE 3210	Multimedia Engineering Lab	50	1.0
CSE 3211	Project-1	100	1.0
CSE 3212	Viva Voce	50	1.0
	Total	900	20.0

Fourth Year : Semester I			
Course No.	Course Title	Marks	Credit
CSE 4101	Artificial Intelligence & Soft Computing	100	3.0
CSE 4102	Artificial Intelligence & Soft Computing Lab	50	1.5
CSE 4103	Pattern Recognition	100	3.0
CSE 4104	Pattern Recognition	50	1.0
CSE 4105	Communication Engineering	100	3.0
CSE 4106	Communication Engineering Lab	50	1.0
CSE 41XX	Optional-1	100	2.0
CSE 41XX	Lab Based on Optional Subject	50	1.0
CSE 41XX	Optional-2	100	2.0
CSE 41XX	Lab Based on Optional Subject	50	1.0
CSE 4112	Industrial Tour/ Training /Project – 2	100	2.0
	Total	850	20.5

Fourth Year : Semester II			
Course No.	Course Title	Marks	Credit
CSE 4201	Digital Signal Processing	100	3.0
CSE 4202	Digital Signal Processing Lab	50	1.0
CSE 4203	Cryptography and Network Security	100	3.0
CSE 4204	Cryptography and Network Security Lab	50	1.5
CSE 4205	Software Engineering	100	3.0
CSE 4206	Software Engineering Lab	50	1.0
ACC 4207	Industrial Management and Accountancy	100	2.0
CSE 42XX	Optional-3	100	2.0
CSE 42XX	Lab Based on Optional Subject	50	1.0
CSE 4212	Thesis/Project – 3	150	3.0
CSE 4214	Viva Voce	50	1.0
	Total	900	21.5

Optional Courses for Forth Year :Semester I	
Course No.	Course Title
CSE 4113	Cloud Computing

Optional Courses for Forth Year :Semester I	
Course No.	Course Title
CSE 4115	Bio-informatics
CSE 4117	Mobile Computing
CSE 4119	Data Mining
CSE 4121	Machine Learning
CSE 4123	Robotics
CSE 4125	Compiler design
CSE 4127	System Simulation and Modeling
CSE 4129	Introduction to IoT
CSE 4131	Digital Image Processing
CSE 4133	Parallel and Distributed Computing

Optional Courses for Forth Year :Semester II	
Course No.	Course Title
CSE 4215	Computational Geometry
CSE 4217	Wireless Communication
CSE 4219	Graph theory
CSE 4221	Digital Forensic
CSE 4223	VLSI Design
CSE 4225	Internet Engineering
CSE 4227	Algorithm Engineering
CSE 4229	Network Design and Management

Distribution of Undergraduate Courses

Nature of Courses		Credits	Percentage
Humanities		8	5.00 %
Basic Sciences with Lab		23	14.38 %
Core Courses	Theoretical	84	52.50 %
	Laboratory / Project	41	25.62 %
	Board Viva-voce	4	2.50 %
	Total	160	100.00 %

Distribution of Marks and Credit:

Year	Semester	Marks	Credit
1st	1st	700	18.0
	2nd	750	19.5
2nd	1st	750	19.0
	2nd	850	20.0
3rd	1st	800	21.5
	2nd	900	20.0
4th	1st	850	20.5
	2nd	900	21.5
Total:		6500	160.0

Detail Outline of the Courses

CSE 1101: Introduction to Computer Systems
(Credit: 3   Contact Hours: 3 Hours/Week)

Computer Generations and Classification: Computer History, Block diagram, Generations, Classification, Distributed Computer system, Parallel Computer System. Computers in society.
Data representation: Number systems, Binary arithmetic, Binary Codes, alphanumeric codes, Error detecting and correcting, Representation of characters, integers, and fractions; Logic gates, Boolean algebra. Logic Circuits;
Hardware Components: Basic Units of Computer Hardware, Keyboard, Mouse, Internal structure of CPU, Functions of RAM, ROM and Cache memory, Basic functional mechanism of HDD and CD-ROM, Monitors, Printers, Scanner, Plotter, Typical Computer specifications,
Software Components: Programming languages, Assembler, Compiler and Interpreter, Structured and blocked structured languages, procedural and non-procedural programming, Types of software: Systems software, Application packages.
Operating Systems: Operating System (OS) functions, Properties and components of OS, classification, and Example of Operating Systems: DOS, Windows and Linux.
Internet and Webpage Design: Types of Communications with and among computers, Need for Computer Communication Networks, Internet and the World Wide Web, HTML, CSS.
Computer Ethics: Computers in the workplace; Computer crime; Rules of communications; Privacy; Intellectual property.

Books Recommended:
- P. K. Sinha   : Fundamentals of Computer
- V. Rajaraman   : Fundamentals of Computers

CSE 1102: Introduction to Computer Systems Lab
(Credit: 1   Contact Hours: 2 Hours/Week)

Laboratory works based on CSE 1101

CSE 1103: Structured Programming Language
(Credit: 3   Contact Hours: 3 Hours/Week)

Problem solving techniques: Problem Analysis, Algorithm, Flowchart, Debugging, Coding and Documentation;
C Basics: Data types, Operator, operands; Conditional operators; Loops; Error handling;
Functions and Arrays: User–defined functions; Recursive functions; Scope of variables; one-dimensional, Multi-dimensional arrays
Pointers and Strings: Pointers; Pointers and array; Pointers and functions; String I/O; String operations; Pointer and string.
File: File Access, Opening, Closing, I/O operations, updating binary and sequential files
Structure and Unions, Linking libraries and header files, Operations on bits; Register variable; Pre-processors in C
Books Recommended
- H Schildt   : Turbo C/C++: The Complete Reference
- Gottfried   : Programming with C

CSE 1104: Structured Programming Language Lab
(Credit: 1.5   Contact Hours: 3 Hours/Week)

Laboratory works based on CSE 1103

EEE 1105: Fundamental of Electrical Engineering
(Credit: 3   Contact Hours: 3 Hours/Week)

Electrical Circuits: Fundamental electrical concepts and measuring units. Direct current: voltage, current, resistance and power. Laws of electrical circuits and methods of network analysis

The Magnetic Field: Definition of B, Effect of magnetic force on current, Torque on a current Loop, Hall effect; Ampere's Law: B near a long wire, Magnetic lines of induction, Two parallel conductors, B for a solenoid, The Biot-Savart's Law.

Electromagnetic: Maxwell's Equation, Electromagnetic wave equation and propagation, Pointing vector, Faraday's laws of electromagnetic induction, Lenz's Law, Motional e.m.f, Eddy current. Self and Mutual Inductance.

Electrical Circuit: Concepts of Electrical Networks; Kirchhoff's law with voltage and current sources; Thevenin's and Norton's Theorems; Superposition Theorem; Maximum Power Transfer Theorem; Star and Delta Conversions;

AC Theory and Circuits: General AC Theory; AC Power; Average & RMS Value of AC Voltage & Current, Series and Parallel Resonant circuits.

Book Recommended:
- B.L. Theraja   :   Electrical Technology , S. Chand
- Robert L. Boylestad   :   Introductory Circuit Analysis, Pearson

EEE 1106: Fundamental of Electrical Engineering Lab
(Credit: 1.5   Contact Hours: 3 Hours/Week)

Laboratory works based on CSE 1105

HUM 1107: Communicative English
(Credit: 1   Contact Hours: 1 Hours/Week)

Grammar: Grammatical principles, modals, phrases & idioms, prefixes & suffixes, sentence structures, WH & yes/ no questions, conditional sentences.

Vocabulary building: Correct and precise diction, affixes, level of appropriateness. Colloquial and standard, informal and formal.

Reading: Comprehension of technical & non-technical materials-skimming, scanning, inferring & responding to context.

Writing: Paragraph & composition writing on scientific & other themes, report writing, research paper writing, library references.

Listening: Listening to recorded texts and class lectures and learning to take useful notes based on listening.

Spoken: Introduction to phonetic symbols, dialogue, responding to particular situations, narrating events.

Professional communication: Business letter, job application, memos, quotations, tender notice.

Books Recommended
- NitinBhatnagar   :   Communicative English for Engineers and Professionals
- Alan Barker   :   Improve Your Communication Skills
- Owen Hargie   :   The Handbook of Communication Skills

HUM 1108: Communicative English Skills Lab

Laboratory works based on CSE 1107

MATH 1109: Algebra and Trigonometry
(Credit: 3   Contact Hours: 3 Hours/Week)

Elements of Set Theory: Introduction to sets. Set Algebra. Types of sets: Finite, infinite, countable and uncountable sets. Relations and Functions.

Matrices: Definition and Algebra of matrices; Special types of matrices. Determinant of a square matrix: Properties; Crammer's rule; Rank of a matrix; elementary transformation and normal form. The adjoint and inverse of a square matrix. Matrix inversion by partitioning; Solution of system of linear equations: Gauss-Jordan method.

Theory of equations: Relation between roots and coefficients. De Carte's rule of sign. Solution of cubic and biquardratic equations. Symmetric functions of the roots.

Trigonometry: Complex number. De-Moiver's Theorem and it applications. Functions of complex arguments. Gregory's series. Summation of trigonometric series. Hyperbolic functions.

Books Recommended
- Bernard and Child   **:**   Higher Algebra
- Das and Mukherjee   **:**   Higher Trigonometry

First Year: Semester II

CSE 1201: Data Structures
(Credit: 2   Contact Hours: 2 Hours/Week   Prerequisite: CSE 1103)

Introduction: Basic Terminology, Elementary Data Organization, Data Structures, Algorithms, and Complexity of Algorithms

Stacks, Queues and Recursion: Fundamentals, Different types of stacks and queues: Circular, deques etc.; Evaluation of expressions, Multiple stacks and queues; Recursion, Direct and indirect recursion, Depth of recursion, Simulation of Recursion, Removal of Recursion; Towers of Hanoi.

Graphs: Introduction, definition and terminology, graph representations, traversals, connected components and spanning trees, shortest path and transitive closure, activity networks, topological sort and critical paths, enumerating all paths.

Trees: Basic terminology, Binary trees, binary tree representations, binary tree traversal; Binary search tree, tree search, Insert into a search tree, tree sort algorithm, deletion from a search tree, Building a binary search tree, Inserting a node, AVL trees, Forming a heap;

Linked Lists: Single linked lists, Linked stacks and queues, the storage pool, polynomial addition, equivalence relations, sparse matrices, doubly linked lists and dynamic storage management, generalized lists, garbage collection and compaction.

Extended binary trees: 2-trees, internal and external path lengths, Huffman codes/algorithm; Threaded binary trees, binary tree representation of trees; Application of Trees: Set representation, decision trees, game trees; Counting binary trees.

Sorting: Searching, bubble sort, shell sort, insertion sort, selection sort, quick sort, heap sort, 2-way merge sort, sorting on several keys, practical considerations of internal sorting.

Books Recommended
- Lipschutz   **:**   Data Structures, Schaum's Outline
- Taunenbaum, Langsam **:**   Data Structure Using C

CSE 1202: Data Structures Lab
(Credit: 1   Contact Hours: 2 Hours/Week)

Laboratory works based on CSE 1201

EEE 1203: Electronic Devices and Circuits
(Credit: 3   Contact Hours: 3 Hours/Week)

Energy Bands in Solids: The nature of the Atom, Atomic energy levels, Valence and conduction bands, Conductors, Semiconductors and Insulators.

Semiconductor Diode and Rectifiers: Semiconductors' characteristics and their types, P-N Junction Diodes and their V-I Characteristics; Zener Diode, Ideal Rectifier Concept, P-N Junction Diode as a Rectifier; Half-wave and Full-wave Rectifiers; Rectifier Filters and Ripple Factor, Voltage Regulator Using Zener Diode, Clipper, Clamper.

Transistor: PNP and NPN Junction Transistors; CB, CE and CC Configurations and their V_c-I_c Characteristics; Transistor Action; Different Types and Biasing; Bias Stabilisation; Operating Point; DC and AC Load Lines; Dynamic Transfer Curve, Current, Voltage and Power Gains. Transistor as a Circuit Element, Transistor Hybrid Parameters.

Transistor Amplifiers: Transistor DC Amplifiers; CE, CB and CC Amplifiers and their Equivalent Circuits; Class A, Class B and Class C Amplifiers, class AB pushpull Amplifier.

Feedback Circuits: Feedback Principles and Characteristics; Current and Voltage Feedback Amplifiers; Positive and negative feedback.

Oscillators: Oscillators and Conditions for Sustained Oscillations; RC Phase Shift, Collpit and Crystal Oscillators.

MOS devices: Introduction to JFET, MOSFET, PMOS, NMOS& CMOS: biasing & application in switching circuits.

Optoelectronic devices: PN & PIN photodiode, phototransistor; solar cell, photocell, LED, LCD & alphanumeric display.

Books Recommended:
- Theraja, B L   :   Basic Electronics
- J. Millman& C. C Halkias :   Electronics Devices and Circuits

EEE 1204: Electronic Devices and Circuits Lab
(Credit: 1   Contact Hours: 2 Hours/Week)
Laboratory works based on CSE 1203

CSE 1205: Object Oriented Programming
(Credit: 3   Contact Hours: 3 Hours/Week   Prerequisite: CSE 1105)

Introduction: Object oriented programming and procedural oriented programming, encapsulation, inheritance, polymorphism, data abstraction, data binding, static and dynamic binding, message passing.

Classes: structure of classless. public, private and protected members, array of object, argumented member function,   and non-augmented objects, nested member class and their object, pointer objects and pointer members, object an argument of function, static class member and static class. Friend function, friend class.

Inheritance: mode of inheritance, classifications of inheritance, virtual inheritance.
Array of objects of derived class.

Constructor and Destructors: default constructor, argumented constructor, copy constructor, dynamic constructor, constructor function for derived class and their order of execution, destructor.

Operator and Function Overloading, unary and binary operator overloading, run-time and compile time polymorphism, object pointer and pointer to an object, virtual function, dynamic binding.

Template and Exception Handling: function template and class template, Exception Handling.

CSE 1206: Object Oriented Programming Lab

PHY 1207: Physics
(Credit: 3   Contact Hours: 3 Hours/Week)

Structure of Matter: Structure of matter. Different types of bonds in solids: metallic, van dar waals'; Covalent and Ionic bond, Packing in solids: Inter atomic distances and forces of equilibrium, X-ray diffraction, Bragg's law.

Atomic Physics: Atom models: Thomson atom model, Rutherford atom model, Rutherford scattering formula, Electron orbits, Bohr atom model; Energy levels and spectra; Particle properties of waves.

Waves and Oscillations: Oscillations: Simple harmonic motion, Composition of simple harmonic motions and Lissajous' figures, Damped and Forced oscillations; Resonance; Waves: Wave properties of particle: de Broglie waves, Group velocity, Phase velocity; Travelling and Standing waves; Energy calculation of Traveling and Standing waves; Intensity of waves; Beats; Doppler effect.

Theories of Light: Wave theory: Huygens wave theory; Huygen's principle and construction; Superposition of light waves; Electromagnetic theory; Particle theory: Newton's corpuscular theory, Quantum theory of light.

Interference: Introduction; Conditions of Interference; Young's double slit experiment; Fresnel's biprism; Thin film Interference; Interference due to multiple reflection.

Diffraction: Fresnel's and Fraunhoper diffraction; Diffraction by single and double slit; Diffraction gratings.

Polarization: Introduction; Methods of producing polarized light; Polarization by reflection and refraction; Polarization by double refraction; Constrauvtion of Nicol prism; Production and analysis of polarized light; Optical activity; Optics of crystals; Polarimeters.

Heat and Thermodynamics: Kinetic theory of gases: Maxwell's distribution of molecular speeds, mean free path, equipartition of energy, Brownian motion, Van der Waal's equation of state, First Law of thermodynamics, reversible and irreversible processes, Second Law of thermodynamics, Carnot cycle; Efficiency of heat engines, Carnot's Theorem,

Books Recommended:
- Theraja, B L   : Modern Physics
- Kenneth Krane   : Modern Physics
- Brijlal   : A textbook of Optics

PHY 1208: Physics Lab
(Credit: 1   Contact Hours: 2 Hours/Week)

MATH 1209: Calculus and Differential Equations
(Credit: 3   Contact Hours: 3 Hours/Week)

Differential Calculus: Limits, continuity, and differentiation of real-valued functions. Successive differentiation. Expansion of functions. Maxima and Minima.

Integral Calculus: Methods of substitution. Integration by parts. Integration of special trigonometric and rational functions. Fundamental Theorem Calculus. General properties of definite integrals.

Differential Equations: Exact Solution of First-Order Ordinary Differential Equations: Exact Differential Equations and Integrating Factors, Separable Equations and Equations reducible to this form, Linear Equations and Bernoulli Equations.

Books Recommended
- Das and Mukherjee   : Differential Calculus
- Das and Mukherjee   : Integral Calculus
- Sapely L Ross   : Differential Equations

Second Year: Semester I

CSE 2101: Discrete Mathematics
(Credit: 2   Contact Hours: 2 Hours/Week)

Logic and Proofs: Propositional Logic; Propositional Equivalences; Predicates and Quantifiers; Nested Quantifiers; Rules of Inference; Introduction to Proofs; Proof Methods and Strategy.
Sets and Functions: Sets; Set Representations; Subsets; Power set; Cartesian Products; Set Identities; Operations on sets; Laws of set operation; Properties and laws of various set numbers; Functions; One-to-One and Onto functions; Inverse functions; Compositions of functions; Floor and ceiling functions.
Induction and Recursion: Mathematical Induction; Strong Induction and Well-Ordering; Recursive Definitions and Structural Induction; Recursive Algorithms.
Counting: Basics of counting; Pigeonhole Principle; Permutations and Combinations; Advanced Counting Techniques.
Relations: Introduction to Relations; Functions as Relations; Properties of Relations; Combining Relations; Representing Relations: Matrices and Digraphs; Closures of Relations.
Graph: Graphs and Graph models; Graph terminology and special types of Graphs; Representing Graphs; Isomorphism of Graphs; Connectivity; Graph Algorithms; Planner Graph; Graph Colouring.
Trees: Introduction to trees; Properties of trees; Different types of trees; Application of trees; Tree traversal algorithms; Infix, Prefix and Postfix Notations ; Spanning trees.

Books Recommended
- Rosen, K. H.   : Discrete Mathematics and its Applications
- Koleman& Busby   : Discrete Mathematical Structures for Computer Science

CSE 2102: Discrete Mathematics Lab
(Credit: 1   Contact Hours: 2 Hours/Week)

Laboratory works based on CSE 2101

CSE 2103: Algorithms
(Credit: 3   Contact Hours: 3 Hours/Week)

The study of efficient algorithms and effective algorithm design techniques; Techniques for analysis of algorithms; Asymptotic analysis, worst case and average case behavior, correctness and complexity; Methods for the design of efficient algorithms; Divide and Conquer paradigm, Greedy method, Dynamic programming, Backtracking, Basic search and traversal techniques, Topological sorting; Connected components, spanning trees, shortest paths; Graph algorithms, Lower bound theory, NP-hard and NP-complete problems.

Books Recommended
- Horowitz and Shahny   : Analysis of Algorithms
- Anany Levitin   : Introduction to the design & analysis of algorithms
- Kurt Mehlhorn& Peter Sanders : Algorithms and Data Structures

CSE 2104: Algorithm Lab
(Credit: 1   Contact Hours: 2 Hours/Week)
Laboratory works based on CSE 2103

CSE 2105: Digital System
(Credit: 3   Contact Hours: 3 Hours/Week Prerequisite: EEE1203)

Introduction to Logic Gates: Combinational logic circuits, Minimization of switching functions: Karnaugh map, and Quine-McClusky methods.

Digital Circuits: Half adder; Full adder; Parallel adders; 2's complement system; Look ahead carry adder; The BCD adder, Decoder, Encoder, 7-segment Decoder, Multiplexer and Demultiplexers.

Flip Flop: Latches, Clocked SR, JK, D & T flip-flops, FF timing considerations, Master-slave flip-flops, FF applications; Frequency division & counting.

Counters and Registers: Asynchronous and Synchronous counter, n-mod counters, propagation delay, Parallel up, down and up/down counters, presettable counters, cascading counters, Shift-register counters, Frequency counters, Digital clock.

D/A and A/D conversion: D/A-converter circuitry, DAC specification, and DAC applications. Analog-to-Digital conversion: Digital-ramp, Successive approximation, Flash and tristate ADCs. Digital Voltmeter.

Semiconductor Terminology: Semiconductor memory terminology; Read-Only Memories, ROM architecture, ROM timing, types of ROMs, Flash Memory, ROM applications, Programmable Logic Devices. RAM architecture, Static RAM and Dynamic RAM, Dynamic RAM structure and operation, DRAM read/write cycles, DRAM refreshing, DRAM technology, Expanding word size and capacity, Magnetic bubble and CCD memory.

Books Recommended
- Tocci, R.J.   : Digital systems
- Mano, M   : Computer System Architecture
- Jain R. P.   : Modern Digital Electronics

CSE 2106: Digital System Lab
(Credit: 1   Contact Hours: 2 Hours/Week)
Laboratory works based on CSE 2105

HUM 2107: Economics, Government and Sociology
(Credit: 2   Contact Hours: 2 Hours/Week)

Economics: Nature of the Economics Theory Applicability of Economic Theory to the Problems of Developing Countries, Some Basic Concepts Supply, Demand and their Elasticity. Economics and Technology. Producer's Equilibrium-Isoquant. Production -Factors of Production, Production Possibility Curve-Equilibrium of a Firm, Fixed Cost and Variable Cost, Laws of Returns ,Internal and External Economics and Dis-Economics, Input Output Analysis. Economic Growth and Economic Development and Planning BasicConcept-Saving, Investment, GNP, NNP, Per-Capita Income, Growth Rate, Fiscal Policy, Monetary Policy and Trade Policy and their Relative Applicability in Bangladesh, Planning-Five Year Plans of Bangladesh, Development Problems Related to Agriculture. Industry and Population of Bangladesh.

Government: Basic Concepts of Government and Politics. Functions, Organs and Forms of Modern State and Government, Socialism. Capitalism, UNO, Government and Politics of Bangladesh, Some Major Administrative Systems of Developed Counties. Local Self -Government. Central Government, Public Opinion.

Sociology: Scope, Culture and Civilization Relationship, Social Structure of Bangladesh. Industrial Revolution, Urbanization and Industrialization, Urban Ecology, Cyber Crime and Delinquency, Sociology of Education. Relationship-Sociology and Cyber Crime. Causes and Remedies of Cyber Crime.

Books Recommended

- Svend Rasmussen : Production Economics: The Basic Theory of Production Optimization
- SadanandaPrusty : Managerial Economics
- G. Shabbir Cheema, Vesselin Popovski : Building Trust in Government: Innovations in Governance Reform in Asia
- Javier Treviño : The Cambridge Handbook of Social Problems:, Volume 2

MATH 2109: Geometry and Vector Analysis
(Credit: 3   Contact Hours: 3 Hours/Week)

Analytical geometry of two dimensions: Cartesian and polar coordinates. Change of axes. Pair of straight lines. The general second-degree equation, Circle, System of circles, parabola, ellipse, hyperbola.
Analytical geometry of three dimensions: Rectangular coordinates, plane, straight line, sphere, central conicoids and general equation of the second degree.
Vector Analysis: Definitions and examples of vectors, Theorems on vector and scalar product of vectors. Vector differentiation, vector differential operator, vector integration.

Books recommended

- Rahman & Bhattacharjee : A Text Book of Co-ordinate Geometry & Vector Analysis
- Askwith E H : Analytical Geometry of Conic Sections
- Spiegel M R : Vector Analysis & Tensor Calculus

CHEM 2111: Chemistry
(Credit: 3   Contact Hours: 3 Hours/Week)

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

Books recommended

- Kristi Lew : The Alkali Metals: Lithium, Sodium, Potassium, Rubidium, Cesium, Francium
- M. Satake& Y. Mido : Chemistry Of Transition Elements
- SatyajitSarker, LutfunNahar : Chemistry for Pharmacy Students: General, Organic and Natural Product Chemistry

---

Second Year: Semester II

CSE 2201: Computer Architecture and Organization
(Credit: 3   Contact Hours: 3 Hours/Week Prerequisite: CSE 2105)

Fundamentals of Computer Design: Introduction, definition of performance, job of computer designer, historical perspectives.

Processor Design: Introduction, Processor Organization, information representation, number formats; Instruction types, assembly Language programming; Fixed point Arithmetic: Addition, subtraction, multiplication, division; ALU design, Basic ALU Organization, floating point arithmetic, arithmetic processors; Stack processor.

Control Design: Introduction, Instruction Sequence, instruction interpretation; Hardwired control: Design methods, multiplier control unit, CPU control unit; Micro-programmed control: Basic concepts, control memory optimization, multiplier control unit, Micro-programmed Computers: Conventional and nanno-programmed computers;

Memory Organization: Review of primary and secondary memories; memory hierarchies; High-speed memories, Interleaved memories, Caches, associative memories.

System Organization: Communications: Introduction, bus control; I/O systems: Programmed I/O, DMA and interrupts, I/O processors, Basic concepts of parallel processing.

RISC and CISC Processors: Introduction, data dependency, addressing modes, condition code, register sets, brief study of standard RISC and CISC processors.

Books Recommended
- Hayes, J P   :   Computer Architecture and Organization
- Mano, M   :   Computer System Architecture
- Stone   :   Introduction to computer Architecture

CSE 2202: Computer Architecture and Organization Lab
(Credit: 1   Contact Hours: 2 Hours/Week)
Laboratory works based on CSE 2201

EEE 2203: Switching Devices and Pulse Techniques
(Credit: 2   Contact Hours: 2 Hours/Week Prerequisite: CSE 1203)

Logic Circuits: DL, DTL, DCTL, ETL, TTL, ECTL, IIL, and MOS logic families.

Multivibrators: Astable, Monostable and Bistablemultivibrators, circuit, Multivibrators using Timer, Schmitt trigger.

Operational Amplifiers: Ideal operational amplifier, Uses as an inverter, scale changer, Phase shifter, Integrator, Differentiator, Adder, Subtractor, multivibrator using operational amplifier , Impulse response, Active Filters.

Negative-resistance Devices: General characteristics of negative resistance devices, types of negative-resistance devices, Tunnel diode, SCR, UJT, DIAC, TRIAC: construction, operation and characteristics, a tunnel diode multivibrators, UJT oscillator and SCR power control.

Circuits for generating linear voltage slopes: Simple RC integrator, linear sweep generators using current source, the miller integrator, the bootstrap sweep generator, practical bootstrap circuit, pulse transformer, blocking oscillator

Books Recommended
- Taub and Schelling   :   Switching Devices and Circuits
- Gupta and Kumar   :   Hand Book of Electronics
- B L Theraja   :   Basic Electronics
- Millman and Halkias   :   Electronic Devices and Circuits

EEE 2204: Switching Devices and Pulse Techniques Lab
(Credit: 1   Contact Hours: 1 Hours/Week)
Laboratory works based on CSE 2203

CSE 2205: Web Programming
(Credit: 3   Contact Hours: 3 Hours/Week)

Internet Basics: Concept of Internet, evolution, Specification and establishment details, IP addressing, Internet domains, DNS, ISP. Internet telephony, Intranet and extranet, firewall design issues. Internet applications: FTP, Telnet, Email, Chat, Video conferencing.
World Wide Web: Concepts, Web page: Static, Dynamic, Active; Web server,HTTP protocol.
Web Page Design: Basic concepts of HTML and DHTML, Tags, Cascading Style Sheets, XML and XHTML.
JavaScript: Introduction, Control Structures, Functions, Arrays, and Objects.
Web Programming: PHP, ASP.net, JSP, JQuery, AJAX,WWW database; the creation and updating the web content; Expanding Internet services by adding client-side and server-side processing; Interfacing internet to a database; Querying database. Socket overview, Reserved Socket, Internet Addressing, Java and the Net, InetAddress, TCP/IP Client Sockets, TCP/IP Server Sockets, Datagrams; Datagram Server and Client.

Books Recommended
- Deitel, Deitel, and Nieto   : Internet & World Wide Web How to Program
- Eliot Rusty Harold   : JAVA Network Programming
- Stallings W   : Data Communications and Computer Network

CSE 2206: Web Programming Lab
(Credit: 1.5   Contact Hours: 3 Hours/Week)
Laboratory works based on CSE 2205

CSE 2207: Numerical Methods
(Credit: 2   Contact Hours: 2 Hours/Week)
Solutions of Polynomials and Transcendental Equations. Solution of systems of Linear equations by Gauss-Seidel iterative methods.
Polynomial Interpolation: Errors in interpolation, Newton's Formula, The Lagrange polynomials; Lagrange's interpolation formula for unequally spaced data. Curve fitting.
Numerical Integration: Trapezoidal rules; Simpson's rule; Romberg's formula**.**
Solution of Ordinary Differential Equations: Introduction, Taylor Series Method, Euler's method, the approximation of derivatives of finite differences, Parabolic Differential.
Programs for Trapezoidal rules, Simpson's rule, Romberg's formula, Solution of equation by Gauss- Jordan elimination method, Matrix inversion method.

Books Recommended
- E Balagurusamy   : Numerical Methods
- Rajaraman, V.   : Computer Oriented Numerical Methods
- Kuo   : Computer Application of Numerical Methods.

STAT 2209: Statistics for Engineers
(Credit: 3   Contact Hours: 3 Hours/Week)

Basic Statistical Methods: Variance, Divisor 'n' or 'n-1'?, Covariance and Correlation, Normal Distribution , Cumulative Frequency Distributions, Binomial Distribution, Poisson Distribution, Chi-squared Distribution
Production: Sampling Inspection, Control Charts, Cusum Charts, Significance Tests, Analysis of Variance, Linear Regression.
Engineering Design: Variance Synthesis, Factors of Safety, Tolerances
Research and Development: Design of Experiments, Evolutionary Operation, Multiple Regression, More Statistical Methods Bibliography Background, Measurement, Statistical Computing.

Quality Management: Quality Planning, Quality Organisation, Directing the Quality Function, Controlling the Quality Function, Statistical Engineering.

Books Recommended
- Jim Morrison : Statistics for Engineers: An Introduction
- T. T. Soong : Fundamentals of Probability and Statistics for Engineers

STAT 2210: Statistics for Engineers Lab
(Credit: 1   Contact Hours: 2 Hours/Week)
Laboratory works based on CSE 2209

CSE 2211: Business and Communication Law
(Credit: 1   Contact Hours: 1 Hours/Week)

Principles of law of contracts; Company law: law regarding formation, incorporation, management and winding up of companies; Labor law: law in relation to wages hours, health, safety and other condition to work; The trade union legislation arbitration, the policy of the state in relation to labor; The Factory Act (1965); The Law of compensation (1965).

Books Recommended
- Anurag K. Agarwal : Legal Language and Business Communication
- Satnam Singh Gulshan, Gulshan K. Kapoor, ManishaPaliwal, Sanjib Kumar Basu : Law, Ethics and Communication: For C.A. Professional Competence Examination

ME 2212: Engineering Drawing
(Credit: 1   Contact Hours: 1 Hours/Week)

Scale drawing, Isometric views, Orthographic view Missing line, Sectional view, Auxiliary view, Project on Engineering Drawing and CAD using Auto CAD.

CSE 2214: Viva Voce
50 Marks; 1.0 credit

Third Year: Semester I

CSE 3101: Database Management Systems
(Credit: 3   Contact Hours: 3 Hours/Week)

Introduction to Database System: Purpose of database systems, View of Data, Data Models & Languages, Database Administrator & Users, System Structure

Entity-Relationship Model: Basic Concepts, Design issues, mapping constraints, keys, weak entity sets, E-R diagram and its extended features, design of an E-R database schema, reduction to table

Relational Model: Structure of Relational Database, Relational Algebra, Extended Relational-Algebra Operations, Modification of the database, Views.

Structure Query Language: Background, Basic Structure: Set, Aggregate Functions, Null Values, Nested Subqueries, Derived Relation, Views, Modification, joined relations, DDL.

Integrity Constraints: Domain Constraints, Referential Integrity, Assertions, and Triggers.

Data Storage structure: Overview of physical storage, RAID, File organization and record organization in a File, Data Dictionary storage.

Indexing and Hashing: Basic concepts, Ordered Indices, B+ tree, B tree, Hashing, Index definition in SQL.

Transaction: Transaction concept, Transaction State, Implementation of Atomicity & Durability, Concurrent execution, Serializability, Recoverability, Transaction in SQL.

Database System Structure: Networks types: Centralized, Client-Server, Parallel, Distributed System.

Books recommended

- Korth and Silverchatz   :   Database System Concepts
- O. William   :   Principle of Database Systems
- Jeffrey Ullman   :   Relational Database Management System

CSE 3102: Database Management System Lab
(Credit: 1.5   Contact Hours: 3 Hours/Week)
Laboratory works based on CSE 3101

CSE 3103: Operating Systems
(Credit: 3   Contact Hours: 3 Hours/Week)

Introduction: Evolution, Goals and Components of OS, Types of OS. Operating System Services

Process management: Process states and state transition, Process Control Blocks, Job and Process scheduling, Process Communication, Threads

CPU Scheduling: Scheduling levels, Objectives and criteria, CPU scheduling algorithms, Algorithm Evaluation

Process Synchronization: Process co-ordination, Critical section problems, Semaphores, Monitors, Classical problems of process synchronization.

Deadlock: System Model, Deadlock Characterization, Methods for Handling Deadlocks, Deadlock prevention, avoidance, and detection, Recovery form deadlock, Deadlock handling.

Memory Management: Logical and Physical Address Space, Swapping, Memory allocation schemes, Paging and Segmentation, Segmentation with Paging

Virtual Memory: Demand paging, Performance of Demand Paging, Page replacement algorithms, Allocation of frames, Demand Segmentation

File-System: File and Directory concept, File system structure, Allocation method, Free space Management, Directory Implementation.

Books Recommended

- Silberschatz and Galvin   :   Operating System Concepts
- Stalling, William   :   Introduction to Operating System
- Milenkoviæ, Milan   :   Operating Systems: Concepts and Design
- Tanenbaum, Andrew S.   :   Modern Operating Systems

CSE 3104: Operating System Lab
(Credit: 1.5   Contact Hours: 3 Hours/Week)
Laboratory works based on CSE 3103

CSE 3105: Microprocessors and Embedded System
(Credit: 3   Contact Hours: 3 Hours/Week)

Microprocessor Fundamentals: Microprocessors and microcomputers; Evolution of microprocessors; microprocessor applications; Programming Languages; General architecture of microprocessor; The Memory; Input/Output; Co-processors.

Intel 8085 microprocessor: Internal architecture; Register structure; Programming model; Addressing modes, Instruction set; Programming; Memory subsystem; Bus timing and standards.

Architecture: Architecture of Intel 8086 Microprocessor, its execution unit and bus-interface unit, its registers and flags.

Programming Model: Programming model of 8086 processor, segment-offset address and physical address calculations, even and odd addressing, introduction of different addressing modes, Operating systems and BIOS, Memory organization of PC.

Assembly Language: Introduction to IMB PC Assembly Language, Assembly Language syntax, Program Data, Variables, Named constants, program structure, memory models, Input/Output instruction, Running program, Program Segment Prefix.

Embedded Systems: Introduction, Applications of Embedded Systems, Characteristics of Embedded Systems,Design Parameters, Classification, Processors

Hardware Units: Clock Circuits, Real-Time Clocks and Timers, Reset Circuits, Watchdog Timer and its Reset, Memory, Input, Output and I/O Ports, 1/0 Buses and I/O Interfaces, ADCs and DACs, Software Embedded into System, ROM Image of Embedded Software, Coding of Software, Program Models for Software Designing, Software for Concurrent Processing and Scheduling of Multiple Tasks and ISRs, Device Drivers and Managers.

Structural Units in a Processor: Processor Characteristics, Memory Devices,I/O Devices, Interfacing of Processor, Memory and 1/0 Devices, Case Study of an Embedded System for a Smart Card, Memory Cards, Microprocessor Cards, Contactless Smart Cards.

Books Recommended:

- Ytha Yu and   : Assembly Language Programming and Organization of the IBM PC,
  CharlersMarut   McGraw-Hill
- Rafiquzzaman   : Microprocessor and Microcomputer based System Design, Crc Press
                           Publication
- Ramesh Goanker   : Microcomputer Interfacing, McGraw-Hill

CSE 3106: Microprocessors and Embedded System Lab
(Credit: 1   Contact Hours: 2 Hours/Week)
Laboratory works based on CSE 3105

CSE 3107: Computer Network
(Credit: 3   Contact Hours: 3 Hours/Week)

Concepts of Computer network; Network types; Network architecture protocols; Outline of OSI and TCP/IP reference model; LAN Architecture, LAN Topologies, LAN standards, Wireless LANs, MAC protocols, Bridged Ethernet, Circuit Switching, Packet Switching; Network interconnection, Internet protocol, IP datagram format, IP addressing, Subnetting, Routing Protocols and algorithms, Internet Control Message Protocol (ICMP), DHCP, ARP, RARP; Domain Name System: Name servers; Firewalls.

Books Recommended

1. Behrouz A. Forouzan : Data Communications and Networking
2. Stallings W   : Data Communications and Computer Networks
3. Tanenbaum   : Computer Networks
4. William A Shay   : Understanding Data Communication & Networks

CSE 3108: Computer Network Lab
(Credit: 1.5   Contact Hours: 3 Hours/Week)
Laboratory works based on CSE 3107

MATH 3109: Complex analysis, Laplace and Fourier Transforms
(Credit: 3   Contact Hours: 3 Hours/Week)

Complex Analysis: Complex number system: Complex plane, the extended plane and its spherical representation (Riemann sphere). Complex function: Single and many valued function, Branch point, limit, continuity and differentiability of complex functions. Analytic functions: Necessary and sufficient conditions, Mobius transformation, Power series. Harmonic function. Complex Integration: Power series representation of analytic functions, zeros of analytic functions, Cauchy's theorem, Morera's theorem, Cauchy integral formula, Singularities and its classifications. Maximum modulus theorem, the homotopic version of cauchy's theorem and simple connectivity, the open Mapping theorem, Taylor's and Laurent series, Fundamental theorem of algebra, Rouches theorem. The argument principle, The Residue Theorem Contour integration. Conformal mapping, bilinear mapping. The application of the conformal mapping, Riemann Mapping theorem, Riemann zeta function, Analytic continuation, Riemann surface.

Laplace Transform: Definition, existence and basic properties and related theorems. Inverse Laplace transform and convolution, Solution of linear differential equations with constant coefficients and linear systems.

Fourier Series: Fourier integrals and applications. Fourier sine and cosine transforms, Complex Fourier transform, convolution theorem, Applications to boundary value problem.

Books Recommended
1. 5. J. B. Conway : Functions of one complex variable
2. M. R. Spigel : Theory and problems of Complex variables
3. Rajput: Mathematical physics
4.Spigel: Laplace Transforms

HUM 3110: Technical Writing and Presentation
(Credit: 1   Contact Hours: 1 Hours/Week)

Grammar: Grammatical principles, modals, phrases & idioms, prefixes &suffixes, sentence structures, WH & yes/ no questions, conditional sentences.

Vocabulary: Technical & scientific vocabulary, defining terms.**Spoken English**: Introduction to phonetic symbols, dialogue, responding to
particular situations, extempore speech.

Reading: Comprehension of technical & non-technical materials-skimming,scanning, inferring & responding to context.

Technical Writing: Paragraph & composition writing on scientific &otherthemes, report writing, research paper writing, library references.

Professional communication: Business letter, job application, memos,quotations, tender notice.

Books Recommended:
1. John M. Lannon :**Technical Writing**, *Scott Foresman& Co.*
2. A. J. Thomson & A.V. Martinet: **A Practical English Grammar**, *Oxford UniversityPress*
3. A. Ashley :**Oxford Handbook of CommercialCorrespondence**, *Oxford University Press*
4. John Swales :**Writing Scientific English**, *CengageLearningAustralia*

Third Year: Semester II

CSE 3201: Computer Graphics
(Credit: 3   Contact Hours: 3 Hours/Week)

Introduction to Computer Graphics: Introduction, Presentation graphics, Application Areas, GUI; Graphics Hardware: Display devices Architecture and Input Devices;

Graphic Primitives: Drawing Points, Lines, Circles, Ellipse, Rectangles, Arcs; Polygons: Inside-outside tests, polygon fill algorithms, Character generation;

Two-dimensional Viewing and Clipping: Viewing pipeline, Window to view port transformation, Point, Line, Polygon, Curve and Text clipping;

Transformations of Objects: Basic transformations, Affine Transformations, Translations, Rotations, Scaling, reflection and Shearing, Composite transformations matrices, Transformation of 3D objects (4×4 matrices).

Curve and Surface design: Interpolation and approximation techniques, B-spline, Bezier curves and Surfaces, Fractal Geometry

3D Object Representation: 3D Graphics Pipeline, Projection: Different types of Parallel and Perspective Matrices; B-Rep, Constructive Solid Geometry, BSP tree, Octree, Hidden lines and Surface detection: Back face Detection, Painters algorithm, Z-buffering; light models,

Rendering: Constant, Goraud and Phong shading; Ray-tracing; Different Types of Color Model

Some Topics of Graphics: Introduction to OPEN GL

Books recommended

1. Donald Hearn and Paullin Baker : Computer Graphics
2. Foley, Vandam, Feiner, Hughes : Computer Graphics, Principle and Practice
3. Vera B Anand : Computer Graphics & Geometric Modeling for Engineers

CSE 3202: Computer Graphics Lab
(Credit: 1   Contact Hours: 2 Hours/Week)
Laboratory works based on CSE 3201

CSE 3203: Computer Peripherals and Interfacing
(Credit: 3   Contact Hours: 3 Hours/Week)

Input/Output Devices: Digitizer, Scanners, OCR, bar codes, Magnetic card readers, touch screens, Printers, Monitors etc.

Disks and Drives: Floppy Disk and Drives, Hard Disk and Drives, Compact Disk and Drives etc.

Interface between Computer and the outside world: Sensors, transducers and signal conditioning, Interfacing Memory and I/O Devices such as monitors, printers, keyboard, disk drives, Data acquisition and some other smart interface cards; IEEE488 and other buses and interfacing scientific instruments. Study of Microcomputer's chips.

Microprocessors Supporting Chips: 8155, 8255, DMA controller etc.

Interfacing Real Worlds: Display of decimal & alphanumeric character, Measurement of electrical quantities - frequency, voltage, current etc. Temperature, water level & motor speed measurement. Traffic control.

Books Recommended

1. Rafiquzzaman : Microprocessor and Microcomputer based system design
2. Artwick : Microcomputer Interfacing
3. Ramesh Goanker : Microcomputer Interfacing

CSE 3204: Computer Peripherals and Interfacing Lab
(Credit: 1   Contact Hours: 2 Hours/Week)
Laboratory works based on CSE 3203

<div align="center">

CSE 3205: System Simulation and Modeling
(Credit: 2   Contact Hours: 2 Hours/Week)

</div>

Simulation Modeling Basics: Systems, Models and Simulation; Classification ofSimulation Models; Steps in a Simulation Study.

Concepts in Discrete-Event Simulation: Event-Scheduling vs. Process-InteractionApproaches, Time-Advance Mechanism, Organization of a Discrete-Event SimulationModel; Continuous Simulation Models; Combined Discreet-continuous models; MonteCarlo Simulation; Simulation of Queuing Systems.

Building Valid and Credible Simulation Models: Validation Principles and Techniques,Statistical Procedures for Comparing Real-World Observations and Simulated Outputs,Input Modeling; Generating Random Numbers and Random Variates; Output Analysis.Simulation Languages; Analysis and Modeling of Some Practical Systems.

Books Recommended

1.	Averill M. Law	:	**Simulation Modeling and Analysis**
2.	Christopher A. Chung	:	**Simulation Modeling Handbook: A Practical Approach**
3.	Klaus Wehrle, MesutGünes, James Gross	:	**Modeling and Tools for Network Simulation**
4.	SankarSengupta	:	**System Simulation and Modeling**

<div align="center">

CSE 3206: System Simulation and Modeling Lab
(Credit: 1   Contact Hours: 2 Hours/Week)
Laboratory works based on CSE 3205

</div>

<div align="center">

CSE 3207: Theory of Computation
(Credit: 2   Contact Hours: 2 Hours/Week)

</div>

The Central Concepts: Introduction to Finite State Machines and Finite State Automata; Alphabets, Strings and Languages.

Finite Automata: Deterministic Finite Automata, Non-deterministic Finite Automata, and their applications; Finite Automata with Epsilon-Transitions.

Regular Expressions and Languages: Regular Expressions, Finite Automata and Regular Expressions, Applications of Regular Expressions, and Algebraic Laws for Regular Expressions.

Properties of Regular Languages: The Pumping Lemma for Regular Languages and its applications; Closure Properties and Decision Properties of Regular Languages; Equivalence and Minimization of Automata.

Context-Free Grammars and Languages: Context-Free Grammars; Parse Trees; Applications of Context-Free Grammars; Ambiguity in Grammars and Languages.

Pushdown Automata: Definition and the languages of a PDA; Equivalence of PDA's and CFG's; Deterministic Pushdown Automata.

Introduction to Turing Machines: The Turing Machine, Programming Techniques for Turing Machines, Extensions to the Basic Turing Machine, Restricted Turing Machines, Turing Machines and Computers.

Books Recommended

1.	Hopcropt, J.E. & Ullman , J.D.	:	Introduction to Automata Theory, Languages & Computation
2.	Lewis Papadimitriou	:	Elements of the Theory of Computation
3.	John C Martin	:	Introduction to Languages and Theory of Computation

<div align="center">

CSE 3208: Theory of Computation Lab
(Credit: 1   Contact Hours: 2 Hours/Week)
Laboratory works based on CSE 3207

</div>

CSE 3209: Multimedia Engineering
(Credit: 3   Contact Hours: 3 Hours/Week)

Multimedia systems: introduction; Coding and compression standards; Architecture issues in multimedia.

Operating systems issues in multimedia: real-time OS issues, synchronization, interrupt handling.

Database issues in multimedia: indexing and storing multimedia data, disk placement, disk scheduling, searching for a multimedia document.

Networking issues in multimedia: Quality-of-service guarantees, resource reservation, traffic specification, haping and monitoring, admission control; Multicasting issues; Session directories; Protocols for controlling sessions;

Security issues in multimedia: digital water-marking, partial encryption schemes for video streams.

Multimedia applications: audio and video conferencing, video on demand, voice over IP.

Networked virtual environment(NVE): Networked virtual environment overview; forms of distributed interaction; example systems; NVE technologies and challenges; origins of NVE.

Recommended Books:
1. Ze-Nian Li and Mark S. Drew: Fundamentals of Multimedia
2. John Villamil-Casanova and Louis Molina: Multimedia: An Introduction
3. Tay Vaughan: Multimedia: Making It Work,

CSE 3210:Multimedia Engineering Lab
(Credit: 1   Contact Hours: 2 Hours/Week)
Laboratory works based on CSE 3209

CSE 3211: Project-1
(Credit: 1   Contact Hours: 2 Hours/Week)
Study and solution of problems in the field of Computer Science and Engineering.

CSE 3212: VIVA VOCE
50 Marks; 1.0 credit

Fourth Year: Semester I

CSE 4101: Artificial Intelligence &Soft computing
(Credit: 3   Contact Hours: 3 Hours/Week)

Introduction: Introduction to AI and intelligent agents, General Concept of Knowledge.

Symbolic Knowledge and Reasoning: Building a Knowledge Base Agent, Propositional logic, First order logic, Inference in First order Logic,

Uncertain Knowledge and Reasoning: Inconsistencies and uncertainties, probabilistic reasoning, Structured knowledge, Fuzzy Logic.

Knowledge Organization and manipulation: Search strategies, Game planning, Knowledge Organization and management.

Knowledge acquisition: Introduction, Types of learning, general model, Learning automata, Genetic algorithm, Learning by Induction,

Introduction to Soft Computing: Concept of computing systems, "Soft" compiting versus "Hard" computing, Characteristics of Soft computing, Some applications of Soft computing techniques

Fuzzy logic:Introduction to Fuzzy logic, Fuzzy sets and membership functions, Operations on Fuzzy sets, Fuzzy relations, rules, propositions, implications and inferences, Defuzzification techniques, Fuzzy logic controller design, Some applications of Fuzzy logic.

Artificial Neural Networks: The Basic Neuron, Artificial model of a neuron, Classification of ANN, Learning in ANN, The delta rule, Hebbian learning, McCulloch-Pitts Model, The perceptron, ADALINE, MADALINE, Kohonen Self-Organizing Networks, Hopfield model, Associative memory, Back propagation learning algorithms. Applications of Neural Network.

Books recommended

1.	Dan w. Patterson	:	Introduction to Artificial Intelligence and Expert System
2.	Stuart Russell and Peter Norving	:	Artificial Intelligence: A Modern Approach
3.	E. Rich and K. Knight	:	Artificial Intelligence
4.	Andrea Tettamanzi, Marco Tomassini		Soft Computing: Integrating Evolutionary, Neural, and Fuzzy Systems

CSE 4102: Artificial Intelligence & Soft Computing Lab
(Credit: 1.5   Contact Hours: 3 Hours/Week)
Laboratory works based on CSE 4101

CSE 4103: Pattern Recognition
(Credit: 3   Contact Hours: 3 Hours/Week)

Introduction to Pattern Recognition: Human perceptions, Definition and approaches, Terminology, Learning methods, Decision space and decision boundary, Pattern recognition system design, Applications.

Syntactic Pattern Recognition: Quantifying structure in pattern description and recognition, Grammar based approach and applications, Elements of formal grammar, Recognition of syntactic description, parsing, The CYK parsing algorithm, Augmented transition networks.

Statistical Pattern Recognition: Probability of events, Conditional probability, Statistical decision making, Baye's theorem, Nonparametric decision making, Clustering: Definition and classification, Hierarchical clustering algorithms, Partitional clustering algorithms.

Books Recommended

1.	Beale R and Jackson	:	Neural Computing: An Introduction
2.	Igor Aleksander and Helen Morton	:	An Introduction to Neural Computing

CSE 4104: Pattern Recognition Lab
(Credit: 1   Contact Hours: 2 Hours/Week)

CSE 4105: Communication Engineering
(Credit: 3   Contact Hours: 3 Hours/Week)

Principles of communication system: Basic constituents, classification of RF spectrum, noise

Transmission Lines and media: Introduction, primary line constant, characteristics impedance, propagation coefficient, phase and group velocity, loseless lines at radio frequency. Transmission lines at circuit elements, Smith chart, wire and wireless media.

Data Encoding Techniques: AM, FM and PM, ASK, FSK, PSK, QPSK, PCM, DM, NRZ, NRZL, NRZI, Bipolar AMI, Pseudotemetry, Manchester and differential Manchester encoding.

Error detection techniques: Parity check, Longitudinal Redundancy check and CRC. Data link and error control protocol: Basic characteristics, Flow and error control techniques, Framing. Stop and wait ARQ, HDLC protocol.

Optical fiber: Introduction, Principle of light transmission, losses, dispersion, light sources, photo-detector, connectors and splices. modulation techniques.

Radio wave communication: Introduction, propagation in free space, tropospheric and ionospheric propagation, surface wave. Chapman theory of layer formation, Ionospheric storm.

Satellite communication: Introduction, Types of satellite, construction, Orbit, Attitude control, Station Keeping, altitude, transmission path, VSAT**,** RADAR, SONAR

Books recommended
1. Stallings W   :   Data Communications and Computer Networks
2. Roddy and Coolen   :   Electronic Communications
3. M. S. Roden   :   Analog and Digital communication Systems
4. Kennedy & Davis   :   Electronic Communication Systems
5. William A Shay   :   Understanding Data Communication & Networks
6. D M Pozar   :   Digital Communication

CSE 4106 Communication Engineering Lab
(Credit: 1   Contact Hours: 2 Hours/Week)

CSE 41XX: Optional Courses
(Credit: 2   Contact Hours: 2 Hours/Week)
Student takes two optional courses offered by department and based on their project/thesis

CSE 4112: Industrial Tour/ Training /Project – 2
(Credit: 2   Contact Hours: 3 Hours/Week)

Fourth Year: Semester II

CSE 4201: Digital Signal Processing
(Credit: 3   Contact Hours: 3 Hours/Week)

Introduction to Signals: Concepts of signals, systems and signal processing; classification of signals; Digital signals and systems; Classification of discrete time signals; Sampling theorem; Fourier series and Fourier transform; Autocorrelation.

LTI System: Time domain response, Frequency domain response

The Z-Transform: The Z-Transform and its properties; The inverse Z-Transform.

The Discrete Fourier Transform (DFT): The Discrete Fourier Transform (DFT), redundancy in the DFT; The Fast Fourier Transform (FFT); the FFT decimation in time & decimation in frequency; Interrelationship between the DFT & Z-transform; Convolution of sequences & sectioning.

Digital Filter: Digital Filter characterization; Digital filter structures; Design of Digital Filters; Recursive Filter design; Non-recursive filter design via the DFT computational techniques; Other radix formulations; Spectral analysis using the FFT; Speech processing algorithms;

Books Recommended
1. Proakis&Manolakis   :   Digital Signal Processing
2. Oppenheim & Schafer   :   Discrete Time Signal Processing

CSE 4202:Digital Signal Processing Lab

Laboratory works based on CSE 4201

CSE 4203: Cryptography and Network Security
(Credit: 3 Contact Hours: 3 Hours/Week)

Cryptography:

Overview: CryptographyOverview and Terminologies.

Symmetric Ciphers: Symmetric Cipher Model, Substitution Techniques, Transposition Techniques, Steganography, Simplified DES, Block Cipher Principles, The Data Encryption Standard, The Strength of DES, Block Cipher Design Principles, Evaluation Criteria for AES, The AES Cipher, Triple DES, Blowfish, RC5, Characteristics of Advanced Symmetric Block Ciphers, RC4 Stream Cipher, Placement of Encryption Function, Traffic Confidentiality, Key Distribution.

Number theory: Fields, algebraic closures, Integers - divisibility, primes, testing primes, factorization, Euclidean algorithm

Public-Key Encryption: Principles of Public-Key Cryptosystems, The RSA Algorithm, Key Management.

Network Security:

Message Authentication: Authentication Requirements, Authentication Functions, Message Authentication Codes, Hash Functions, MD5 Message Digest Algorithm, Secure Hash Algorithm, Digital Signatures, Authentication Protocols.

Network Security Practice: Kerberos, Pretty Good Privacy, S/Mime, IP Security Overview, IP Security Architecture, Authentication Header, Encapsulating Security Payload, Web Security Considerations, Secure Socket Layer and Transport Layer Security.

System Security: Intruders, Intrusion Detection, Password Management, Viruses and Related Threats, Virus Countermeasures, Firewalls.

Books Recommended

1. W. Stallings   : Cryptography and Network Security Principles and Practice, *Prentice Hall.*
2. Behrouz Forouzan   : Cryptography and Network Security, *McGraw-Hill*
3. Bruce Schneier   : Applied Cryptography, *John Wiley & Sons.*

CSE 4204: Cryptography and Network Security Lab
(Credit: 1.5 Contact Hours: 3 Hours/Week)
Laboratory works based on CSE 4203

CSE 4205: Software Engineering
(Credit: 3 Contact Hours: 3 Hours/Week)

Introductory concepts: Classification of software products; Software products attributes; The need of software engineering; Software engineers' professional responsibility.

Software Process: Software engineering process, methods, and tools; Generic view of software engineering; Software process models; Fourth generation techniques; Process technology.

Project Management: Overview and importance of project management; Project management activities; Project planning; Activity organization; Project scheduling.

Software metrics: Measuring software; Lines of Code and Function Points; Metrics and software quality.

Risk Analysis and Management: Reactive versus proactive risk strategies; Software risks; Risk identification; Risk projection; Risk refinement; Risk mitigation, monitoring, and management.

Requirements and Specification: Requirements Engineering; Requirements analysis; System models; Requirements definition and specification; Software prototyping; Formal specification; Algebraic Specification; Model-based specification.

Software Design: Software design fundamentals; Architectural design; Object-oriented design; Function-oriented design; Real-time system design; User interface design.

Dependable Systems: Concepts of software reliability, reliability specification and measurement; Fault avoidance; Fault tolerance; Exception handling; Defensive programming.

Verification and Validation: Software testing fundamentals; Testing methods and strategies.

Evolution: Software maintenance; Configuration management; Software Re-engineering.

Books recommended

1. Sommerville, Ian : Software Engineering
2. Pressman, Roger S. : Software Engineering: A Practitioner's Approach
3. Mathew, Sajan : Software Engineering

CSE 4206: Software Engineering Lab
(Credit: 1   Contact Hours: 2 Hours/Week)
Laboratory works based on CSE 4205

ACC 4207: Industrial Management and Accountancy
(Credit: 2   Contact Hours: 2 Hours/Week)

Industrial management: Administration, Management and organization, Authority and responsibility, Scientific management, Organization structure, organization chart, Span of control, Selection and recruitment of employees; training and its types, promotion, wage system and incentive; job-evaluation and merit rating, Plant layout, layout of physical facilities, Transportation and storage, Material handling, Maintenance, Maintenance policy, Production control in intermittent and continuous manufacturing industry, functions of production control, Purchasing procedures : Inventory-need and methods of control, Factors affecting inventory building-up, Economic lot size and reorder point. **Accounting:** Basic accounting, Classification of account, Journal, Ledger, Cash book, Trial Balance, Final account. **Cost Accounting:** Definition and objectives; Elements of a costs; Preparation of a cost sheet, **Marginal costing:** Break even analysis, Process costing.

CSE 42XX: Optional-3
(Credit: 2   Contact Hours: 2 Hours/Week)

CSE 42XX: Optional-3 Lab
(Credit: 1   Contact Hours: 2 Hours/Week)
Laboratory works based on CSE 42XX

CSE 4211: Thesis/Project – 3
150 Marks; 3.0 credits;

CSE 4212: VIVA-VOCE
50 Marks; 1.0 credit

List of Optional Courses

Optional Courses for Fourth Year Semester I

CSE 4113: Cloud Computing

Introduction: Cloud Computing: An Old Idea Whose Time has Come, Cloud Computing Delivery Models and Services, Ethical Issues in Cloud Computing, Major Challenges Faced by Cloud Computing

Cloud Infrastructure: Cloud Computing at Amazon, Cloud Computing: The Google Perspective, *Microsoft Windows Azure* and Online Services, Open-Source Software Platforms for Private Clouds

Cloud Computing: Applications and Paradigms: Challenges for Cloud Computing, Existing Cloud Applications and New Application Opportunities, Architectural Styles for Cloud Applications, Coordination Based on a State Machine Model: The *ZooKeeper,* The *MapReduce*Programming Model

Cloud Resource Virtualization: Virtualization, Layering and Virtualization, Virtual Machine Monitors, Performance and Security Isolation, Full Virtualization and Paravirtualization

Cloud Resource Management and Scheduling: Policies and Mechanisms for Resource Management, Applications of Control Theory to Task Scheduling on a Cloud, Stability of a Two-Level Resource Allocation Architecture, Feedback Control Based on Dynamic Thresholds

Storage Systems: The Evolution of Storage Technology, Storage Models, File Systems, and Databases, Distributed File Systems: The Precursors, General Parallel File System, Google File System, *ApacheHadoop*

Cloud Security: Cloud Security Risks, Security: The Top Concern for Cloud Users, Privacy and Privacy Impact Assessment, Operating System Security, Virtual Machine Security, Security of Virtualization

Recommended Books:
1. Nayan B. Ruparelia : Cloud Computing
2. Dan C. Marinescu : Cloud Computing: Theory and Practice
3. Lizhe Wang, Rajiv Ranjan, Jinjun Chen, BoualemBenatallah : Cloud Computing: Methodology, Systems, and Applications

CSE 4115: Bio-informatics

Introduction and Bioinformatics Resources

Knowledge of various databases and bioinformatics tools available at these resources, the major content of the databases, Literature databases: Nucleic acid sequence databases, Protein sequence databases, Genome Databases, Other Databases of Patterns/Motifs/System Biology.

Sequence Analysis

Various file formats for bio-molecular sequences, Basic oncepts of sequence similarity, identity and homology, definitions of homologues, orthologues, paralogues, basic concept of a scoring matrix, PAM and BLOSUM series, FASTA algorithms, various versions of basic BLAST and FASTA.

Pairwise and Multiple Sequence Alignments

Basic concepts of sequence alignment, Needleman &Wuncsh, Smith & Waterman algorithms for pairwise alignments, Progressive and hierarchical algorithms for MSA. Use of pairwise alignments and Multiple sequence alignment for analysis of Nucleic acid and protein sequences and interpretation of results.

Phylogeny: Phylogenetic analysis, Definition and description of phylogenetic trees and various types of trees, Method of construction of Phylogenetic trees, various computational methods of phylogenetic and molecular evolutionary analysis.

Computational RNA Structure Analysis: Secondary and tertiary structure of RNA. Various algorithms of RNA folding and their analysis.Energy minimization in RNA folding. RNA sequence alignment based on secondary structure and its applications in functional genomics and phylogeny.

Prediction of Protein Structure: Secondary structure: algorithms of Chou Fasman, GOR methods, Tertiary Structure, Protein structure comparison and classification, purpose of structure comparison, algorithms such as FSSP, VAST and DALI.

Recommended Books:
1. Introduction to Bioinformatics by Aurther M lesk
2. Developing Bioinformatics Computer Skills By: Cynthia Gibas, Per Jambeck
3. Structural Bioinformatics
4. Bioinformatics : Methods And Applications Genomics, Proteomics And Drug Discovery

CSE 4117: Mobile Computing

Introduction: Mobile Computing – Mobile Computing Vs wireless Networking – Mobile Computing Applications – Characteristics of Mobile computing – Structure of Mobile Computing Application. MAC Protocols – Wireless MAC Issues – Fixed Assignment Schemes – Random Assignment Schemes – Reservation Based Schemes.

Mobile Internet Protocol and Transport Layer: Overview of Mobile IP – Features of Mobile IP – Key Mechanism in Mobile IP – route Optimization. Overview of TCP/IP – Architecture of TCP/IP- Adaptation of TCP Window – Improvement in TCP Performance.

Mobile Telecommunication System: Global System for Mobile Communication (GSM) – General Packet Radio Service (GPRS) – Universal Mobile Telecommunication System (UMTS).

Mobile Ad-Hoc Networks: Ad-Hoc Basic Concepts – Characteristics – Applications – Design Issues – Routing – Essential of Traditional Routing Protocols –Popular Routing Protocols – Vehicular Ad Hoc networks (VANET) – MANET Vs VANET – Security.

Mobile Platforms and Applications: MobileDevice Operating Systems – Special Constrains & Requirements – Commercial Mobile Operating Systems – Software Development Kit: iOS, Android, BlackBerry, Windows Phone – MCommerce – Structure – Pros & Cons – Mobile Payment System – Security Issues.

Books Recommended:
1. Prasant Kumar Pattnaik, Rajib Mall, "Fundamentals of Mobile Computing", PHI Learning Pvt. Ltd, New Delhi – 2012.
REFERENCES:
2. Jochen H. Schller, "Mobile Communications", Second Edition, Pearson Education, New Delhi, 2007.
3. Dharma PrakashAgarval, Qing and An Zeng, "Introduction to Wireless and Mobile systems", Thomson Asia Pvt Ltd, 2005.

CSE 4119: Data Mining

Data Mining and Applications: Relational Databases, Data Warehouses, Transactional Databases, Advanced Data and Information Systems, Characterization andDiscrimination, Mining Frequent Patterns, Associations, and Correlations, Classificationand Prediction, Cluster Analysis, Outlier Analysis, Evolution Analysis.

Data Preprocessing: Descriptive Data Summarization, Data Cleaning, Data Integrationand Transformation, Data Reduction, Data Discretization and Concept Hierarchy Generation.

Classification, Clustering and Prediction: Classification by Decision Tree Induction,Bayesian Classification, Rule-Based Classification, Classification by Backpropagation,Support Vector Machines, Clustering by Partitioning/ Hierarchical/ Density-based/Gridbased/Model-based Methods, Clustering High-Dimensional Data, Outlier Analysis,Prediction, Linear Regression, Nonlinear Regression, Other Regression-Based Methodsof Prediction, Evaluating the Accuracy and Error Measures of a Classifier or Predictor**.**

Web Mining: Anatomy of a Search Engine, Crawling the Web, Web Graph Analysis,Extracting Structured Data from the Web, Classification and Vertical Search, Web LogAnalysis.

Advanced Analysis: Mining Stream, Time-Series, and Sequence Data, Graph Mining, Social Network Analysis, and Multirelational data Mining, Mining Object, Spatial, Multimedia, and Text Data

Books Recommended:
1. Jiawei Han, Jian Pei, MichelineKamber : Data Mining: Concepts and Techniques
2. Margaret H Dunham : Data Mining: Introductory And Advanced Topics
3. MehmedKantardzic : Data Mining: Concepts, Models, Methods, and Algorithms
4. Charu C. Aggarwal, ChengXiangZhai : Mining Text Data

CSE 4121: Machine Learning

Introduction to machine learning; Learning algorithms: supervised, unsupervised, reinforcement, attribute based, neural network based, relational supervised and negative correlation; Genetic algorithm, genetic programming and evolutionary programming; Practical application of machine learning.

Books Recommended:
- R.S. Michalski, J.G. Carbonell, T.M. Mitchell : Machine Learning: An Artificial Intelligence Approach
- Aboul Ella Hassanien : Machine Learning Paradigms: Theory and Application
- David Edward Goldberg : Genetic Algorithms in Search, Optimization, and Machine Learning
- S.N. Sivanandam, S. N. Deepa : Introduction to Genetic Algorithms

CSE 4123: Robotics

Robotics: History, Present Status and future Trends, Robot Kinematics, Robot Drives, Actuators and Control, Robot End-effectors, Sensors and Intelligent Robots, Robot Languages and Programming.
Basic Electronics and Computer Interfacing, Flexible Automation Technology, Quantitative Techniques for Economic Performance, Applications of Robots.

Recommended Books:
1. Robotics Technology and Flexible Automation   S R Deb, Tata McGraw-Hill, 1994
2. Introduction to Robotics,   AJ.Critchlow,MacmilanPub.Coj.
3. Mechanisms and Robot Manipulators,   J Duffy,EdwardArnold Ltd
1. Industrial Robotics Technology, Programming and Applications: M P Grover et al.

CSE 4125: Compiler Design

Introduction: Phases of a compiler (lexical analyzer, syntax analyzer, semantic analyzer, intermediate code generator, code optimizer, code generator, symbol-table manager & error handler).
Lexical analysis: role, finite automata, from regular expression to NFA, from NFA to DFA, design of a lexical anlyzer generator using LEX.
Syntax analysis: role, CFG, writing a grammar, top-down parsing, bottom-up parsing, operator precedence parsing, LR parser, using ambiguous grammar, parser generators (YACC).
Symbol table, structure and management.
Intermediate code generation: intermediate languages, declarations, assignment statement, Boolean expression, case statements, backpatching, procedure calls.
Code optimization: principle of source optimization, optimization of basic blocks, loop in flow graphs, global data flow analysis, iterative solution of data flow equations.

Code generation: Issues in the design of a code generator, target machine, runtime storage management, basic blocks and flow graphs, register allocation and assignment, dag representation of basic blocks, peephole optimazations, generating code from dags.

Books recommended
- Hopcroft and Ullman   **:**   Introduction to Automata Theory, Languages and Computation
- Adamek   **:**   Automata and Algebra
- Aho and Ullman   **:**   Principles of Compiler Design
- Lewis and Stern   **:**   Compiler Design Theory

CSE 4127: System Simulation and Modeling

Simulation Modeling Basics: Systems, Models and Simulation; Classification ofSimulation Models; Steps in a Simulation Study.

Concepts in Discrete-Event Simulation: Event-Scheduling vs. Process-InteractionApproaches, Time-Advance Mechanism, Organization of a Discrete-Event SimulationModel; Continuous Simulation Models; Combined Discreet-continuous models; MonteCarlo Simulation; Simulation of Queuing Systems.

Building Valid and Credible Simulation Models: Validation Principles and Techniques,Statistical Procedures for Comparing Real-World Observations and Simulated Outputs,Input Modeling; Generating Random Numbers and Random Variates; Output Analysis.Simulation Languages; Analysis and Modeling of Some Practical Systems.

Books Recommended

1. Averill M. Law	**:**	Simulation Modeling and Analysis
Christopher A. Chung	**:**	Simulation Modeling Handbook: A Practical Approach
2. Klaus Wehrle, MesutGünes, James Gross	**:**	Modeling and Tools for Network Simulation
3. SankarSengupta	**:**	System Simulation and Modeling

CSE 4229: Introduction to IoT

Introduction: Internet of Things Promises–Definition– Scope–Sensors for IoT Applications–Structure of IoT– IoT Map Device

Seven Generations of IoT Sensors to Appear: Industrial sensors – Description & Characteristics–First Generation – Description & Characteristics–Advanced Generation – Description & Characteristics–Integrated IoT Sensors – Description & Characteristics–Polytronics Systems – Description & Characteristics–Sensors' Swarm – Description & Characteristics–Printed Electronics – Description & Characteristics–IoT Generation Roadmap

Technological Analysis: Wireless Sensor Structure–Energy Storage Module–Power Management Module–RF Module–Sensing Module

IoT Development Examples:ACOEM Eagle – EnOcean Push Button – NEST Sensor – Ninja Blocks - Focus on Wearable Electronics

Preparing IoT Projects: Creating the sensor project - Preparing Raspberry Pi - Clyster libraries - Hardware- Interacting with the hardware - Interfacing the hardware- Internal representation of sensor values - Persisting data - External representation of sensor values - Exporting sensor data - Creating the actuator project- Hardware - Interfacing the hardware - Creating a controller - Representing sensor values - Parsing sensor data - Calculating control states - Creating a camera - Hardware -Accessing the serial port on Raspberry Pi - Interfacing the hardware - Creating persistent default settings - Adding configurable properties - Persisting the settings - Working with the current settings -Initializing the camera

Recommended Books:

1. Dr. Guillaume Girardin , Antoine Bonnabel, Dr. Eric Mounier, 'Technologies & Sensors for the Internet of Things Businesses & Market Trends 2014 - 2024',Yole Développement Copyrights ,2014
2. Peter Waher, 'Learning Internet of Things', Packt Publishing, 2015
3. Editors OvidiuVermesan Peter Friess,'Internet of Things – From Research and Innovation to Market
4. Deployment', River Publishers, 2014
5. N. Ida, Sensors, Actuators and Their Interfaces, Scitech Publishers, 2014.

CSE 4231: Digital Image Processing

Introduction and Fundamental to Digital Image Processing: What is Digital Image Processing, Origin of Digital Image Processing, Examples that use Digital Image Processing, Fundamental steps in Digital Image Processing, Components of Digital Image Processing System, Image sensing and acquisition, Image sampling, quantization and representation, Basic relationship between pixels.

Image Enhancement in the Spatial Domain & Frequency domain: Background, Basic gray level transformation, Histogram processing, Basics of spatial filtering, Smoothing and Sharpening Spatial filters, Introduction to Fourier Transform and the Frequency Domain, Discrete Fourier Transform. Smoothing and Sharpening Frequency-Domain filters.

Image Restoration: Image Degradation/Restoration Process, Noise models, Restoration in presence of noise, Inverse Filtering, Minimum Mean Square Filtering, Geometric mean filter, Geometric transformations.

Color Image Processing: Color Fundamentals, Color models, Basis of full color image processing, Color transformations.

Image Compression: Fundamentals, Image compression models, Error free compression, Lossy compression.

Morphological image processing: Preliminaries, Dilations and Erosion, opening and closing, Some basic morphological algorithms.

Image Segmentation: Detection of Discontinuities, Edge linking and boundary detection, Thresholding, Region oriented segmentation.

Representation, Description and Recognition: Representation-chain codes, polygonal approximation and **skeletons**, Boundary descriptors-simple descriptors, shape numbers, Regional descriptors- simple, topological descriptors, Pattern and Pattern classes-Recognition based on matching techniques.

Recommended Books:
1. Rafeal C. Gonzalez & Richard E. Woods :Digital Image Processing
2. A. K. Jain: Fundamentals of Digital Image Processing
3. Mark S. Nixon & Albert S. Aguado: Feature Extraction and Image Processing
4. William K. Pratt: Digital Image Processing

CSE 4233: Parallel and Distributed Computing

Introduction to parallel processing: Evolution of computer systems, Parallelism in uni-processor system, Parallel computer structures, Architectural classification scheme, Parallel processing application.

Principles of pipelining and Vector processing: Instruction and arithmetic pipelines, Pipelining – an overlapped parallelism, Designing pipeline processing, Vector processing requirements.

Pipeline computers and vectorization methods: The space of pipelined computers, Early vector processors, Scientific attached processors, Recent vector processors, Vectorization and optimization methods.

Structures and algorithm for Array processors: SIMD array processors, SIMD interconnection networks, Parallel algorithm for array processors, Associative array processing.SIMD computers and performance enhancement.

Multiprocessor architecture and programming: Functional structures, Interconnection networks, parallel memory organization, Multiprocessor operating systems, Multiprocessing control and algorithm.

An overview of Multiprocessor Systems: Some examples, Data flow computers and VLSI computation.

Distributed Systems: Distributed memory parallel machine architecture concepts, disjoint address spaces, globalization of address spaces, message passing, synchronous and asynchronous communication.

Books recommended:
1. Computer Archtecture and Parallel Processing   K Hwang, and Briggs
2. Parallel Computing: Theory and Practice   G J Lipovski and Malok
3. Elements of Parallel Computing   V Rajaraman

Optional Courses for Fourth Year Semester II

CSE 4215: Computational Geometry

Introduction: Definition of Computational Geometry, Limitations of Computational Geometry, Affine Geometry, Affine Space, Geometric primitives, Degeneracies and Robustness, Application Domains.
Geometric Data Structures: Vectors, Points, Polygons, Edges, Geometric Objects in Space.
Incremental Insertion: Insertion sort, Star-shaped polygons, Convex Hulls, Insertion Hull, Point enclosure, Ray-Shooting method, Line clipping, Polygon clipping, The Sutherland-Hodgman Algorithm.
Incremental Selection: Selection sort, Gift-Wrapping, Grahams scan method, Removing of hidden surfaces, Delaunay Triangulation, Mate of an Edge, Voronoiregions,Voronoi Diagrams, Duality of Voronoi Diagrams and Deluanay Triangulations.
Plane Sweep Algorithms: Line segments intersections, Event Points, The Sweep line structure,Monotone Polygon, Monotone Polygon Theorem, Decomposition of Polygons.
Divide and Conquer Algorithms: Merge sort, Intersection of half planes, Kernel of a polygon, Merge Hull, Closest Points, Polygon Triangulation, Polygon Triangulation theorem.
Visibility Graphs: Algorithms for weak and strong visibility,Planar Graphs, Art Gallery Problems, Shortest Paths for a point Robot, Shortest paths for a translating Polygonal Robot.
Combinational Geometry: Hamm-Sndwich cuts, Helly's theorem, K-sets,
Rectilinear Geometry: Intersection and union of Rectangles, Rectangle searching.
Books recommended:

1.	M. de Berg, M. van Kreveld, Mark Overmars&Otfried Schwarzkopf	Computational Geometry: Algorithms and Applications.
2.	Shanon	Computational Geometry
3.	Michael J. Laszlo	Computational Geometry and Computer Graphics in C

CSE 4217: Wireless Communication

Introduction to Wireless Communication: Evolution of mobile communications, mobile radio systems around the world, trends in cellular radio and personal communications.
Modern Wireless Communication Systems: Second generation (2G) Cellular networks, third generation (3D) wireless networks, wireless local loop (WLL) and LMDS, wireless local area networks (WLANs), Bluetooth Personal area networks (PANs).
The cellular Concept – System Design Fundamentals: Introduction, frequency reuse, channel assignment strategies, type of handoffs, handoff strategies, interference and system capacity, trunking and grade of service, improvement of coverage and capacity in cellular systems.
Mobile Radio Propagation: Introduction to radio wave propagation, free space propagation model, relating power to electric field, basic propagation mechanisms, reflection, ground reflection, diffraction, scattering, outdoor and indoor propagation models.
Small scale Fading and Multi-path: Small scale multi-path propagation, Impulse response model of a multi-path channel, small-scale multi-path measurements, parameters of mobile multi-path channels,

types of small scale fading, Rayleigh and Ricean distributions, statistical models for multi-path fading channels, theory of multi-path shape factors for small scale fading wireless channels.

Modulation techniques for mobile radio: Frequency modulation, amplitude modulation, angle modulation, digital modulation, line coding, pulse shaping techniques, geometric representation of modulated signals, linear modulation techniques.

Equalization, Diversity and Channel Coding: Introduction, fundamentals of equalization, linear inequalities, nonlinear equalization, algorithms for adaptive equalization, diversity techniques, interleaving, fundamentals of channel coding.

Speech Coding: Introduction, characteristics of speech signals, quantization techniques, ADPCM, frequency domain coding of speech, vocoders, and linear predictive coders.

Multiple Access Techniques for Wireless Communications: Introduction, FDMA, TDMA, spread spectrum multiple access, SDMA, packet radio, reservation protocols, capacity of cellular systems.

Y-Max: Introduction to Y-max technology.

Recommended Books:
1. Wireless Communications   Theodore S. Rappaport
2. Wireless and Mobile Network Architectures   Yi-Bing Lin, ImrichChlamtac
3. Mobile Wireless Communications   Mischa Schwartz

CSE 4219: Graph theory

Introduction: Graphs – Introduction – Isomorphism – Sub graphs – Walks, Paths, Circuits – Connectedness – Components – Euler graphs – Hamiltonian paths and circuits – Trees – Properties of trees – Distance and centers in tree – Rooted and binary trees.

Trees, Connectivity & Planarity: Spanning trees – Fundamental circuits – Spanning trees in a weighted graph – cut sets – Properties of cut set – All cut sets – Fundamental circuits and cut sets – Connectivity and separability – Network flows – 1-Isomorphism – 2-Isomorphism – Combinational and geometric graphs – Planer graphs – Different representation of a planer graph.

Matrices, Colouring and Directed Graph: Chromatic number – Chromatic partitioning – Chromatic polynomial – Matching – Covering – Four color problem – Directed graphs – Types of directed graphs – Digraphs and binary relations – Directed paths and connectedness – Euler graphs.

Permutations &Combinations: Fundamental principles of counting – Permutations and combinations – Binomial theorem – combinations with repetition – Combinatorial numbers – Principle of inclusion and exclusion – Derangement – Arrangements with forbidden positions.

GENERATING FUNCTIONS:Generating functions – Partitions of integers – Exponential generating function – Summation operator – Recurrence relations – First order and second order – Non-homogeneous recurrence relations – Method of generating functions.

Books recommended:
1. NarsinghDeo, "Graph Theory: With Application to Engineering and Computer Science", Prentice Hall of India, 2003.
2. Grimaldi R.P. "Discrete and Combinatorial Mathematics: An Applied Introduction", Addison Wesley, 1994.
3. Clark J. and Holton D.A, "A First Look at Graph Theory", Allied Publishers, 1995.
4. Mott J.L., Kandel A. and Baker T.P. "Discrete Mathematics for Computer Scientists and Mathematicians" , Prentice Hall of India, 1996.

CSE 4221: Digital Forensic

Introduction: What Is Forensic Science? What Is Digital Forensics? Uses of Digital Forensics,Criminal Investigations, Civil Litigation, Intelligence, Administrative Matters, Locard's Exchange Principle, Scientific Method,Organizations of Note, Scientific Working Group on Digital Evidence, American

Academy of Forensic Sciences,American Society of Crime Laboratory Directors/ Laboratory Accreditation Board National Institute of Standards and Technology (NIST),American Society for Testing and Materials (ASTM), Role of the Forensic Examiner in the Judicial System.

Labs and Tools: Forensic Laboratories, VirtualLabs, Lab Security, Evidence Storage Policies and Procedures, Quality Assurance, Tool Validation, Documentation, Digital Forensic Tools, Tool Selection, Hardware, Software, Accreditation, Accreditation versus Certification.

Collecting Evidence: Crime Scenes and Collecting Evidence, Removable Media, Cell Phones Order of Volatility, Documenting the Scene, Photography, Notes Chain of Custody, Marking Evidence , Cloning, Purpose of Cloning ,. The Cloning Process, Forensically Clean Media, Forensic Image Formats Risks and Challenges, Value in discovery, Live System versus Dead System, Live, Acquisition Concerns, Advantage of Live Collection, Principles of Live Collection, Conducting and Documenting a Live Collection Hashing, Types of Hashing Algorithms, Hashing Example, Uses of Hashing, Final Report .

Windows System Artifacts: Deleted Data, Hibernation File (Hiberfile.sys), Sleep, Hibernation, Hybrid Sleep Registry, Registry Structure, Attribution, External, Print Spooling, Recycle Bin, Metadata, Removing Metadata. Thumbnail Cache Most Recently Used (MRU) Restore Points and Shadow Copy,Restore Points, Shadow Copies, Prefetch, Link Files, Installed Programs.

Antiforensics: Hiding Data, Early Encryption, Algorithms, KeySpace, Some Common Types of Encryption, Breaking Passwords Password Attacks, Brute Force Attacks, Password Reset, Dictionary Attack, Steganography, Data Destruction, Drive Wiping.

Legal: The Fourth Amendment, Copyrighted material, Criminal Law—Searches without a Warrant, Reasonable Expectation of Privacy, Private Searches, E-mail, The Electronic Communications, Privacy Act (ECPA),

Network Forensics: Social Engineering, Network Fundamentals, Network Types, Network Security Tools Network Attacks Incident Response Network Evidence and Investigations, Network.

Mobile Device Forensics: Cellular Networks, Cellular Network Components, Types of Cellular Networks, Operating Systems,Cell Phone Evidence,Call Detail Records, Collecting and Handling Cell Phone Evidence,Subscriber Identity Modules, Cell Phone Acquisition: Physical and Logical, Cell Phone Forensic Tools, Global Positioning Systems (GPS).

Books Recommended:

1.	John Sammons	:	**The Basics of Digital Forensics: The Primer for Getting Started in Digital**
2.	Cory Altheide, Harlan Carvey	:	**Digital Forensics with Open Source Tools**
3.	Eoghan Casey	:	**Digital Evidence and Computer Crime: Forensic Science, Computers**
4.	Lei Chen, Hassan Takabi, Nhien-An Le-Khac	:	**Security, Privacy, and Digital Forensics in the Cloud**

CSE 4223: VLSI Design

VLSI design methodology: top-down design approach, technology trends.

MOS technology: Introduction to MOS technology, operation of MOStransistor as a switch and amplifier, MOS, NMOS, CMOS inverters, passtransistor and pass gates, DC and transient characteristics.

Overview of fabrication process: NMOS, CMOS, Bi-CMOS process.

NMOS and CMOS layout: Stick diagram, and design rules.

CMOS circuit characteristics: Resistance and capacitance, rise and falltime, power estimation.

Introduction to Bi-CMOS circuits: Shifter, adder, counter, multipliers. DataPath and memory structures, Buffer circuit design.

Design style: FPGA and PLDs.

Books Recommended:

1.	K. Eshraghian& D. A. Pucknell	:	Basic VLSI design: System & Circuit, Prentice-Hall
2.	R. K. Brayton	:	Logic Minimization Algorithms for VLSISynthesis, Kluwer Academic Publishers Norwell, MA, USA.
3.	F. Lombardi and M. G. Sami	:	Testing and Diagnosable Design of VLSIand ULSI, Springer.
4.	C. A. Mead and L. A	:	Introduction to VLSI Systems, Addison

5. A. Albert RAJ, T. Latha   :   VLSI Design

CSE 4225: Internet Engineering

Introduction: Communication model, Communication software, and communication protocol: Representation, Development methods, Protocol engineering process. NETWORK REFERENCE MODEL: Layered architecture, Network services and interfaces, protocol functions, OSI model, TCP/IP protocol suite, Application protocols.

Protocol Specification: Communication service specification, Protocol entity specification, Interface specifications, Interactions, Multimedia protocol specifications, Internet protocol specifications.

Specification and Description Language (SDL): Examples of SDL based protocol specifications; Examples of SDL based protocol specifications, other protocol specification languages. Protocol Verification and Validation, Protocol verification, Verification of a protocol using finite state machines.

Protocol validation: Protocol validation, Protocol design errors, and protocol validation approaches, SDL based protocol verification, SDL based protocol validation.

Protocol Conformance Testing: Conformance testing methodology and framework, Conformance test architectures, Test sequence generation methods, Distribute architecture by local methods, Conformance testing with TTCN, Conformance testing of RIP, Multimedia applications testing, SDL based tools for conformance testing.

Protocol Performance Testing: SDL based performance testing of TCP, OSPF, Interoperability testing, SDL based interoperability testing of CSMA/CD and CSMA/CA protocol using bridge, Scalability testing.

Protocol Synthesis: Synthesis methods, interactive synthesis algorithms, automatic synthesis algorithm, automatic synthesis of SDL from MSC protocol re synthesis.

Books Recommended:
1. Sanjay Jha, Mahbub Hassan   :   Engineering Internet QoS
2. Man Young Rhee   :   Internet Security: Cryptographic Principles, Algorithms and Protocols
3. Eiji Oki, Roberto Rojas-Cessa,   :   Advanced Internet Protocols, Services, and Applications
    MallikarjunTatipamula,
    Christian Vogt

CSE 4227: Algorithm Engineering

Measuring Algorithm Efficiency: Implementation independent measurement of algorithm efficiency, time and space resources, growth in terms of input size, polynomial vs. exponential growth algorithms, worst and average case efficiency, big Oh notation, algorithm efficiency vs. inherent problem (any algorithm) complexity, certificates, verification algorithms, decision trees, table lookup, popular algorithm notations, deterministic and nondeterministic algorithms, algorithm analysis techniques, induction, recurrence equations, amortization, standards and implementation dependent resource measurement.

Data Type Specification and Data Structure Implementation: Tools for algorithm design, abstract data types, selecting data structures, stacks, queues, priority queues, trees, heaps, ROM lookup tables/trees, hash tables, radix, residue and rational number representation, arrays and linked structures, data structure conversion and compression, data structure search and traversal, binary search, balanced data structures.

Algorithm Design Paradigms Characterization of algorithm design paradigms, greedy, divide-and-conquer, dynamic programming, backtracking, branch-and-bound, utilization of design paradigms for problems across application areas of sorting, selection, computer arithmetic and algebraic computation, graphs and networks, bio informatics, computational geometry.

Algorithm Implementation Project: Project description, specifying computational environments, data structure and algorithm selection, test problem design, walkthrough, illustrations, implementation validation, measuring implementation efficiency, result display

Books Recommended:
1. Matthias Müller-Hannemann, Stefan Schirra : Algorithm Engineering: Bridging the Gap Between Algorithm Theory and Practice
2. Thomas H..Cormen, Thomas H Cormen, Charles E Leiserson, Ronald L Rivest, Clifford Stein : Introduction To Algorithms
3. Steven S Skiena : The Algorithm Design Manual
4. Jon Kleinberg, ÉvaTardos : Algorithm Design

CSE 4229: Network Design and Management

Computer Networks and Internet: Internet - The network edge- The network core- Delay , Loss and Throughput in packet switched networks- protocol layers and their service models- TCP/IP protocol architecture- Frame relay networks- ATM networks- protocol architecture- ATM logical connections- ATM cell.

Congestion Control in Data Networks and Internet: Effects of congestion - Congestion control - Traffic management - Congestion control in packet switching networks - Frame relay- Congestion control -TCP flow control and TCP congestion control.

Quality of Service in IP Networks: Integrated services architecture - Queuing discipline- Random early detection - Differentiated service - Resource reservation -RSVP- multiprotocol label switching- Real time transport protocol.

Network Management: Network management - architecture and organization- network management perspectives-NMS platform- SNMPv3 - architecture- applications- Management information base- Remote monitoring- RMON1 - RMON2.

Network Management Tools, Systems and Engineering: System utilities for Management - Network statistics measurement systems- NMS design- Network management systems- Configuration management - fault management - fault management- performance management.

Books Recommended:
1. William Stallings **:** Computer Networking with Internet protocols and Technology
2. Mani ubramanian **:** Network Management
3. William Stallings **:** High speed networks and Internet

Panel of Question Setters, Script Examiners, and Tabulators

1. All teachers, Dept. of Computer Science & Engineering, I. U, Kushtia.
2. All teachers, Dept. of Information & Communication Technology, I. U, Kushtia.
3. All teachers, Dept. of Applied Physics, Electronics & Communication Engineering, I. U, Kushtia.
4. All teachers, Dept. of Mathematics, IU, Kushtia.
5. All teachers, Dept. of Computer Science & Engineering, D. U.
6. All teachers, Dept. of EEE, D. U.
7. All teachers, Dept. of Computer Science & Engineering, R. U.
8. All teachers, Dept. of Applied Physics & Electronic Engineering, R. U.
9. All teachers, Dept. of Information & Communication Engineering, R. U.
10. All teachers, Dept. of Electronics & Computer Science, J. U.
11. All teachers, Dept. of Computer Science, C. U.
12. All teachers, Dept. of Computer Science & Engineering, BUET.
13. All teachers, Dept. of Computer Science & Engineering, K. U.
14. All teachers, Dept. of Computer Science & Engineering, KUET, Khulna.
15. All teachers, Dept. of Computer Science & Engineering, RUET, Rajshahi.
16. All teachers, Dept. of Computer Science & Engineering, SUST.
17. All teachers, Dept. of Computer Science & Engineering, DUET.
18. All teachers, Dept. of Computer Science & Engineering, CUET.
19. All teachers, Dept. of Computer Science & Engineering, JatiyaKabiKaziNazrul Islam University, Trisal.
20. All teachers, Dept. of CIT, Patuakhali Science and Technology University, Patuakhali.
21. All teachers, Dept. of CSE, Noakhali Science and Technology University, Noakhali.
22. All teachers, Dept. of CSE, Comilla University, Comilla.
23. All teachers, Dept. of CSE, Comilla University, Comilla.
24. All teachers, Dept. of CSE, HaziDanesh Science and Technology University (HDSTU), Dinajpur.
25. All teachers, Dept. of Telecommunication Engineering, HDSTU, Dinajpur.
26. All teachers, Dept. of CSE, Begum Rokeya University, Rangpur.
27. All teachers, Dept. of EEE, Pabna Science and Technology University, Pabna.
28. All teachers, Dept. of CSE, Pabna Science and Technology University, Pabna.
29. All teachers, Dept. of APECE, Pabna Science and Technology University, Pabna.
30. All teachers, Dept. of CSE, JSTU, Jassore.
31. All teachers, Dept. CSE, Jagannath University, Dhaka.
32. All teachers, Dept. CSE, Chittagong University, Chittagong.
33. All teachers, Dept. CSE, BSMRSTU, Gopalganj.

Chairman
Department of Computer Science & Engineering
Islamic University,
Kushtia, Bangladesh