Department of Computer Science and Engineering
University of Dhaka

Syllabus for B.Sc. in Computer Science and Engineering

Semester I

Course Code	Course Title	Credit Hours
	Major Theory Courses	
CSE-1101	Computer Fundamentals	2.0
CSE-1102	Programming Fundamentals	3.0
	Major Lab Courses	
CSE-1111	Computer Programming Lab I	1.5
	Total (Major)	**6.5**
	Minor Theory Courses	
EEE-1121	Electrical Circuit Analysis	3.0
PHY-1122	Physics	3.0
CHM-1123	Chemistry	3.0
MATH-1124	Calculus	3.0
	Minor Lab Courses	
EEE-1131	Electrical Circuit Analysis Lab	1.5
	Total (Minor)	**13.5**
	Total Credits in 1st Semester	**20.0**

Semester II

Course Code	Course Title	Credit Hours
	Major Theory Courses	
CSE-1201	Discrete Mathematics	3.0
	Major Lab Courses	
CSE-1211	Computer Programming Lab II	1.5
	Total (Major)	**4.5**
	Minor Theory Courses	
EEE-1221	Digital Systems	3.0
EEE-1222	Basic Electronics	3.0
MATH-1223	Linear Algebra	3.0
STAT-1224	Introduction to Statistics	3.0
APE-1225	Engineering Drawing	2.0

	Minor Lab Courses	
EEE-1231	Digital Systems and VHDL Lab	1.5
EEE-1232	Electronics Lab	1.5
	Total (Minor)	**17.0**
	Total Credits in 2nd Semester	**21.5**

Semester III

Course Code	Course Title	Credit Hours
	Major Theory Courses	
CSE-2101	Data Structure	3.0
CSE-2102	Object Oriented Programming	3.0
CSE-2103	Computer Architecture	3.0
	Major Lab Courses	
CSE-2111	Data Structure Lab	1.5
CSE-2112	Object Oriented Programming Lab	1.5
CSE-2113	Computer Architecture Lab	1.5
	Total (Major)	**13.5**
	Minor Theory Courses	
MTM-2121	Ordinary Differential Equation	3.0
STAT-2122	Introduction to Probability	3.0
BUS-2123	Introduction to Business	2.0
	Total (Minor)	**8.0**
	Total Credits in 3rd Semester	**21.5**

Semester IV

Course Code	Course Title	Credit Hours
	Major Theory Courses	
CSE-2201	Database System	3.0
CSE-2202	Microprocessor and Assembly Language	3.0
CSE-2203	Design and Analysis of Algorithms	3.0
	Major Lab Courses	
CSE-2211	Database Lab	1.5
CSE-2212	Microprocessor and Assembly Language Lab	1.5
CSE-2213	Design and Analysis of Algorithms Lab	1.5
	Total (Major)	**13.5**

	Minor Theory Courses	
MTM-2221	Numerical Analysis	3.0
ECO-2222	Economics	2.0
SCO-2223	Sociology	2.0
	Total (Minor)	**7.0**
	Total Credits in 4th Semester	**20.5**

Semester V

Course Code	Course Title	Credit Hours
	Major Theory Courses	
CSE-3101	Peripheral and Interfacing	3.0
CSE-3102	Data and Telecommunications	3.0
CSE-3103	Software Engineering	3.0
CSE-3104	Operating System	3.0
	Major Lab Courses	
CSE-3111	Peripheral and Interfacing Lab	1.5
CSE-3112	Data and Telecommunications Lab	1.5
CSE-3113	Operating System Lab	1.5
	Total (Major)	**16.5**
	Minor Theory Course	
ENG-3221	Professional English	2.0
GEN-3222	Bangladesh Studies	2.0
	Total (Minor)	**4.0**
	Total Credits in 5th Semester	**20.5**

Semester VI

Course Code	Course Title	Credit Hours
	Major Theory Courses	
CSE-3201	Software Design pattern	3.0
CSE-3202	Computer Networking	3.0
CSE-3203	Finite language, Automata and Computation	3.0
CSE-3204	System Programming	3.0
CSE-3205	Mathematics for Computer Science	3.0
	Major Lab Courses	
CSE-3212	Computer Networking Lab	1.5
CSE-3213	System programming Lab	1.5
CSE-3214	Software Design pattern Lab	1.5
	Total (Major)	**19.5**

	Total Credits in 6th Semester	**19.5**

Semester VII

Course Code	Course Title	Credit Hours
	Major Theory Courses	
CSE-4101	Artificial Intelligence	3.0
CSE-4102	Compiler Design and Construction	3.0
CSE-4103	Computer Graphics	3.0
CSE-4104	E-Commerce and Web Engineering	3.0
	Major Lab Courses	
CSE-4111	Artificial Intelligent Lab	1.5
CSE-4112	Compiler Lab	1.5
CSE-4113	Computer Graphics Lab	1.5
CSE-4114	E-Commerce and Web Engineering Lab	1.5
	Total (Major)	**18.0**
	Total Credits in 7th Semester	**18.0**

Semester VIII

Course Code	Course Title	Credit Hours
	Major Theory Courses	
CSE-4201	Distributed Systems	3.0
CSE-4202	Advanced Database	3.0
CSE-42XX	Optional Course	3.0
	Major Lab Courses	
CSE-4211	Distributed Systems Lab	1.5
CSE-4212	Advanced Database Lab	1.5
CSE-42XX	Optional Course Lab	1.5
CSE-4251	Project/Industry Attachment	5.0
	Total (Major)	**18.5**
	Total Credits in 8th Semester	**18.5**

	Total Credits in 8 Semester	**160.0**

Optional Courses

Course Code	Course Title	Credit Hours
CSE-4261	Simulation and modeling	3.0
CSE-4262	Cryptography and Network Security	3.0
CSE-4263	Digital Signal Processing	3.0
CSE-4264	Digital Image Processing	3.0
CSE-4265	Multimedia	3.0
CSE-4266	Pattern Recognition	3.0
CSE-4267	Design and Analysis of VLSI Systems	3.0
CSE-4268	Micro-controller and Embedded System	3.0
CSE-4269	Cyber Law and Computer Forensic	3.0
CSE-4271	Natural Language Processing	3.0
CSE-4272	System Analysis and Design	3.0
CSE-4273	Optical Fiber Communication	3.0
CSE-4274	Human Computer Interaction	3.0
CSE-4275	Graph Theory	3.0

Optional Courses Lab

Course Code	Course Title	Credit Hours
CSE-4281	Simulation and modeling Lab	1.5
CSE-4282	Cryptography and security Lab	1.5
CSE-4283	Digital Signal Processing Lab	1.5
CSE-4284	Digital Image Processing Lab	1.5
CSE-4285	Multimedia Lab	1.5
CSE-4286	Pattern Recognition Lab	1.5
CSE-4287	Design and Testing of VLSI Systems Lab	1.5
CSE-4288	Micro-controller and Embedded System Lab	1.5
CSE-4289	Cyber Law and Computer Forensic Lab	1.5
CSE-4291	Natural Language Processing Lab	1.5
CSE-4292	System Analysis and Design Lab	1.5
CSE-4293	Optical Fiber Communication Lab	1.5
CSE-4294	Human Computer Interaction Lab	1.5
CSE-4295	Graph Theory Lab	1.5

Year	Major	Minor
1st Semester	**6.5**	**13.5**
2nd Semester	**4.5**	**17.0**
3rd Semester	**13.5**	**8.0**
4th Semester	**13.5**	**7.0**
5th Semester	**16.5**	**4.0**
6th Semester	**19.5**	**0.0**
7th Semester	**18.0**	**0.0**
8th Semester	**18.5**	**0.0**
Total	**110.5**	**49.5**

Total Credits	**110.5+49.5**	**160**

First Semester

Major Courses

Theory Courses

CSE-1101: Computer Fundamentals [2.0 credit, 30 Hours Lecture]

Introduction to Computers: Computer basics, Components of a computer system, Importance and limitations of computers, Classification of computer (based on purpose, signals, capacity), History of computers, Computer generations. **Microcomputer System:** Microcomputer basics, PC and PC clones, Hardware organizations of microcomputer, Bus architecture, Motherboard and its components, Adapter boards. **Input and Output Devices:** I/O operations and interfaces, Keyboard, Reading devices, Pointing devices, Scanning devices, Monitor, Printer, Plotters, Voice output system. **Microprocessors:** Functions of microprocessors, Organization of a microprocessor, Arithmetic logic unit, Control unit, Classification based on generations, Classification based on characteristics, RISC versus CISC, Special processors. **Memory Organization:** Classification of memory, General properties of memory devices, Memory hierarchies, Read only memory, Random access memory, Cache memory, Secondary memory: Floppy disk, Hard disk, Optical disk, Comparisons of primary memory and secondary memory. **Computer Software:** Software, Classification of software, Commercial software, Freeware, Advantages of package programs, Popular package programs, Programming languages, High level languages. **System Software and Operating System:** System software, The role of BIOS, Language translators, Text editor, The tasks of an OS, OS characteristics, Types of OS, Linux, UNIX, MS DOS, Windows. **Database Concepts:** Basic Concepts, Database software, database structures, Database management system, Benefits and limitations of database management. **Computer Networks and the Internet:** Introduction to computer network, Network terminologies, LAN topology, Transmission media, General characteristics of WAN, Bandwidth, Communication over telephone lines, Evolution of the internet, Internet services, Internet address, Electronic mail, The world wide web, introduction to some protocols. **IT Applications:** Concepts and applications of IT, Multimedia hardware and software, Compression and decompression, Electronic Commerce, Access control, Security, Privacy. Introduction to the security of computer network, Computer and its impact on society.

CSE-1102: [3.0 credit, 45 Hours Lecture]

Introduction of Computer Programming, Problem solving techniques, algorithm specification and development. Programming style, debugging and testing, documentation. Program design methodologies, structured and modular program design. **Programming Language in C:** Introduction to C, programming file structure: purpose of .h and .c files, Simple Makefile, constant, variable and data types, operator and expression, type conversion, decision making,-branching and looping, arrays and strings, user defined functions, structures and union, bit field and bit-wise operations, pointer, file management in C, command line arguments, dynamic memory allocation and linked list, preprocessor, low level programming, managing input/output operation. **Unix shell:** shell command, filters, viewing file and statistics, comparing and sorting, pipe, text processing, regular expression, grep family. **Shell Programming:** variables, environment variables, built in variables; defining words – quotes; test – string, number, file properties, Boolean operators; control structure – if-then-else, case, while loop, for loop. **Make:** Managing large program, Makefile, Makefile rules.

Laboratory Courses

CSE 1111: Computer Programming Lab I [1.5 Credit, 45 Hours]

Objectives: Laboratory classes are based on course CSE-1102. The goal of this lab is to provide students with the skills needed to effectively design, develop, implement, debug, test, and maintain programs and more generally to solve problems using a computer. Students will be asked to solve various problems in a regular basis to increase their programming ability. Student should clearly understand the purpose of header(.h) and source(.c) files. Learn to writing Makefile and use of make for compilation and linking. The student will use both the integrated development environment(such as eclipse) and command line compilation to run programs. Several simple problems will be given based on basic shell and awk scripting to familiar with shell scripting. At the end of the class, students will have to develop a simple programming project.

Minor Courses (For CSE Students)

Theory Courses

EEE-1121: Electrical Circuit Analysis [3.0 credit, 45 Hours Lecture]

Active and passive components: resistor, properties of resistors, types of resistors, Ohm's law, power, energy, efficeincy etc. Capacitors: electric field, capacitance, dielectric strength, lleakage current, types of capacitance, charging and discharging phase, initial conditions, capacitor in series and parallel, the current ic, energy stored by a capacitor. Inductor: magnetic field, inductance, Faraday's law, Lenz's law, self-inductance, types of inductors, R-L, R-C and R-L-C circuits with DC input, storage and release phase in R-L transients, initial conditions, inductors in series and parallel, steady state conditions, energy stored by an inductor. Magnetic circuits: reluctance, Ohm's law for magnetic circuits, Ampere's circuit law, hysteresis, flux, sereis and Series-parallel magnetic circuits. Analysis of series DC circuits: Kirchoff's voltage law, voltage divider rule, power distribution, voltage regulation, voltage sources in series, etc. Analysis of parallel DC-circuits: conductance and resistance, Kirchoff's current law, current divider rule, open circuit, short circuit, voltage sources in parallel, etc. Analysis of series-parallel network: reduce and return approach, block diagram approach, ladder networks. Methods of analysis for DC networks: current source, source conversion, current sources in sereis and in parallel, branch-current analysis, mesh analysis, nodal analysis, bridge network, Y-Δ and Δ-Y conversions. Network theorems (DC): superposition theorem, Thevenin's theorem, Norton's theorem, maximum power transfer theorem, Millman's theorem, substitution theorem, reciprocity theorem. Sinusoidal alternating waveforms: the sine wave, general format for the sinusoidal voltage or current. phase relations, etc. Response of basic R, L and C elements to a sinusoidal voltage or current, frequency responses of the basic elements, average power and power factor, rectangular and polar form, conversion between forms, phasors. Analysis of series and parallel AC circuit: Impedance and phasor diagram, voltage divider rule, frequency response of the series ac circuit, admittance and susceptance, current divider rule, frequency response of the parallel elements, equivalent circuits, etc. Analysis of series-parallel AC networks. Methods of analysis for AC network: independent and dependent sources and source conversions, mesh analysis, nodal analysis, bridge network, Y-Δ and Δ-Y conversions.. Network theorems (ac): superposition theorem, Thevenin's theorem, Norton's theorem, maximum power transfer theorem, Millman's theorem, substitution theorem, reciprocity theorem. Power (ac): average power, apparent power and reactive power, the power triangle, Resonance: series resonant circuit, parallel resonant circuit, quality factor, selectivity etc. Filters: low-pass and high-pass filter, band-pass filter, etc. Introduction to transformers: Single phase and three phase transformer.

PHY-1122: Physics [3.0 credit, 45 Hours Lecture]

Waves and Oscillations: Simple harmonic motion: Differential equation of a simple harmonic oscillator, Total energy and average energy, Combination of simple harmonic oscillations, Lissajous figures, Spring-mass system, Calculation of time period of torsional pendulum, Damped oscillation, Forced oscillation, Resonance; Wave: basic definitions, Differential equation of a progressive wave, Power and intensity of wave motion, Stationary wave, Group velocity and phase velocity; Architectural acoustics, Reverberation and Sabine's formula. **Heat and Thermodynamics:** Principle of temperature measurements; Thermal expansion; Kinetic theory of gases: Ideal gas equation and it's correction, Maxwell's distribution of molecular speeds, Mean free path, Equipartition of energy; First law of thermodynamics and it's applications; Reversible and irreversible processes, Second law of thermodynamics, Carnot cycle, Efficiency of heat engines, Carnot's theorem, Entropy and disorder; Thermodynamic functions, Third law of thermodynamics. **Properties of Matter:** Review of Surface tension, Viscosity, Elasticity; Crystalline and non-crystalline solids, Unit cell, Lattice and Basis, Bravais Lattices, Crystal Planes and Miller indices, Interplanar Spacing, Simple crystal structures: NaCl, CsCl, Bragg's Law, methods of determination of crystal structure; Defects in solids: point defects, line defects; Bonds in solids, inter-atomic distances, calculation of cohesive and bonding energy; Introduction to band theory: distinction between metal, semiconductor and insulator; Dielectric Properties of matter: Meaning of Dielectric, Polarization – Electronic, ionic and orientational, Frequency dependence of dielectric constant; Magnetic properties of matter: Different types of magnetic materials; Introduction of superconductivity. **Physical Optics:** Theories of light, Interference of light, Young's double slit experiment; Displacement of fringes and its uses, Frenels Bi-prism, Interference at wedge shaped films, Newton's rings, Interferometers; Diffraction of light, Frenel and Fraunhoffer diffraction; Polarized light, Brewter's law, Malus law, Polarization by double refraction, Retardation plates, Nicol prism, Optical activity, Polarimeters, Polaroid. **Electricity and Magnetism:** Electrostatics: Fields, Potentials, Capacitors and Dielectrics; Steady-State Current, RC Circuits, Time Varying Current And

Fields, Steady-State Magnetic Fields, Electromagnetic Induction, Maxwell's Equations, Poynting's Theorem, Wave Equation, Waves in Vacuum and in Materials, Transmission and Reflection at Boundaries, Guided Waves, Dispersion. **Modern Physics:** Special Theory of Relativity:Postulates of Special Theory of Relativity, Length Contraction, Time Dilation, Relativity of Mass, Mass and Energy Relation, Velocity Addition Theorem, Twin Paradox, Massless Particles; Atomic Structure: Electron Orbits, Atomic Spectra, The Bohr Atom, Energy Level and Spectra, Corresponding Principle, Atomic Excitation.

CHM-1123: Chemistry [3.0 credit, 45 Hours Lecture]

Atomic Structure: Bohr atomic model. Wave nature of electron. Heisenberg uncertainty principle. Schrodinger equation. Quantum numbers. Pauli exclusion principle. Afbau principle. Hund's rule. Electronic configuration. **Periodic Table:** s, p, d and f-block elements. Periodic law. Ionization potential. Electro-negativity. Electron affinity. Atomic radii. Diagonal relationship. Metals, semi metals, metalloids, non metals and their properties. **Noble Gases:** Occurrence. Properties and uses. **Chemical Bonding:** (a) Strong bond: Ionic bond, covalent bond. Coordinate covalent bond and their properties. (b) Weak bond: Hydrogen bond, Vander Waal's force. **Oxidation Reduction:** Charge concept. Electronic concept. Oxidizing agent. Reducing agent. Oxidation number. Balancing the oxidation reduction equation. **Acid Base:** Bronsted concept. Lewis concept. Ionization of water. pH. Transmission curve. Indicators. Buffer. Handerson equation. **State of Matter:** (a) Solid. Liquid. Gas and their differences. (b) Gas laws: Boyle's law, Charles' law, Avogadro's law. Ideal gas. Real gas. Ideal gas equation. Vander Waal's equation. Kinetic theory of gases. **Solutions:** Types of solution. Units of solution concentration. Collegative properties. Raoult's law. Elebation of boiling point. Depression of freezing point. Solubility of gases. Osmotic pressure. **Phase Rule:** Definition. Phase rule of water and carbon dioxide. **Thermodynamics:** First law. Second law. Third law and their application. **Chemical Kinetics:** Rate law. Rate equation. Order of a reaction. First order reaction. Half life. **Chemical Equilibrium:** Equilibrium. Mass action law. Equilibrium constant. **Electrochemistry:** Conductance. Resistance. Equivalence conductance. Faraday's law. Electrolytes. Electrolytic cell. **Selective Organic Reactions:** Friedel Craff's reaction. Alkylation reaction. Markonikov reaction. Grignard reagent. Aromatic compounds. Aldehyde. Ketone. Alcohol. Amine.

MATH-1124: Calculus [3.0 Credit, 45 Hours Lectures]

Differential Calculus

Function and their graphs (polynomial and rational functions, logarithmic and exponential functions, trigonometric functions and their inverses, hyperbolic functions and their inverses, combination of such functions).

Limits of Functions: definition. Basic limit theorems with proofs: limit at infinity and infinite limits Continuous functions. Algebra of continuous functions. Properties Continuous functions on closed and boundary intervals (no proof required).

Differentiation : Tangent lines and rates of change. Definition of derivative. One-sided derivatives. Rules of differentiation (proofs and applications). Successive differentiation.

Leibnitz theorem. Related rates. linear approximations and differentials.

Rolle's theorem : Lagrange' s and cauchy's mean value theorems. Extrema of functions. problems involving maxima and minima. Concavity and points of inflection.

Taylor's theorem with general form of the remainder ; Lagrange's and Cauchy's forms the remainder. Taylor's series. Differentiation and integration of series. Validity of Taylor expansions and computations and computations with series. indeterminate forms. I, Hospital's rules.

Integral calculus

Integral : Antiderivatives and indefinite-integrals. Techniques of integration. Definite integration using antiderivatives. Definite integration using Riemann sums.

Fundmental theorems of calculus. Basic properties of integration. integration by reduction.

Application of integration : Plane areas. Solids of revolutions. Volumes by cylindrical shells volumes by cross-sections. are length and surface of revolution.

Improper integrals. Gamma and beta functions.

Graphing in polar co-ordinates. Tangents to polar curves. Area and length in polar coordinates.

Laboratory Courses

EEE-1131: Electrical Circuit Analysis Lab [1.5 Credit, 45 Hours]

Objectives: Laboratory classes are based on EEE-1121. Students will be introduced with basic electrical components such as capacitor, inductors and electronic devices such as diode, BJT, FET and their characteristics. They will implement different network theorems.

Second Semester

Major Courses

Theory Courses

CSE-1201: Discrete Mathematics [3.0 credit, 45 Hours Lecture]

Methods of proof: Mathematical Induction. **Counting:** functions and counting, pigeonhole principle, permutations and combinations, generalized permutations and combinations, inclusion-exclusion principle. **Propositional and Predicate Calculus:** Statements and Compound statements,tautologies and contradictions, logical equivalence, algebra of propositions conditionals, arguments and theory of inference of prepositional calculus, predicates: variables and quantifiers predicate formulas,theory of inference for the predicate calculus. **Theory of Sets:** Basic concepts sets and elements, venn diagram and membership table, set operations, algebra of sets duality classes of sets, power set. Introduction to Principles of mathematical induction. **Functions:** Basic concept, one-to-one and onto functions. **Relations:** Basic concepts, resentation of relations, types of relations, properties of relations, partial orderrings and equvalance relation. **Recurrence Relation:** Solving recurrence relation, generating functions. **Number Theory:** Division Algorithms-GCD, LCM,prime numbers and prime factorization, modular arithmatic and congruance, modular exponentiation, Eucledian algorithm.introduction to groups, rings and fields. **Graph:** Basic definitions and different types of graphs, Representation of Graphs, Isomorphism, Conectivity, Planner Graphs, Eulers Formula, Kuratowski's Theorem, Eulerian and Hamiltonian Graphs, Graph Coloring techniques and applications. **Tree:** Properties of Tree, rooted trees, tree traversal, spanning tree.

Laboratory Courses

CSE 1211: Computer Programming Lab II [1.5 Credit, 45 Hours]

Minor Courses (For CSE Students)

Theory Courses

EEE-1221: Digital Systems [3.0 credit, 45 Hours Lecture]

Introductory concepts, Binary, octal and hexadecimal number system BCD, ASCH and EBCDIC codes, **Combinatorial Logic:** Data representation Logic gates and Boolean algebra, Combinational Circuits design using NAND of NOR gates only trouble shooting case studies. Minimization of switching functions algebraic simplification the Karnaugh map, VEKM, Quince Mc Cluskey method. **Introduction to VHDL and CAD tools:** hardware description and simulation, **Sequential Logic**: NAND and NOR latches. Clocked SR. JK D and T flip-flops. FF timing consideration. Master-slave FF. Application, **Finite State Machines:** FSMs in VHDL, FSM minimization. **Complex Sequential logic:** Frequency division and counting troubleshooting case studies. Asynchronous ripple up and down counters, counters with any MOD numbers asynchronous IC counters, propagation delay. Parallel up down and up/down counters. Presentable counters. The 74193 counter. Decoding a counter. Cascading counters. Sift registers IC shift digital clock, trouble shooting case studies. MSI logic circuits: BCD-to-do decimal decoders, BCD-to-7 segment decoder/drivers. Encoders. **Multiplexer and Demultiplexer**: Multiplexes and their applications. Demultiplexers. Troubleshooting case studies Analog-to, digital conversion, digital-ramp, successive approximation, flash and tractate ADC. Digital-to-analogue conversion: circuits, specifications. Sample and hold circuits, Analog multiplexers. Data acquisition, digital voltmeter, **Integrated Circuits Logic**

Families: TTL logic family standard TTL series characteristics, other TTL series TTL loading rules, TTL open-collector outputs tractate TTL. The ECL family. Digital MOSFET circuits, characteristics CMOS, driving TTL **Memory Devices:** Semiconductor memory technologies ROM architecture timing and type of ROM, EPROM, EEPROM, ROM applications. RAM architecture static and dynamic RAM, DRAM structure operation and refreshing. Expanding word size and capacity. Magnetic bubble and CCD memories trouble shooting case studies. Introduction to sequential circuits, formal representation of sequential circuits. **Arithmetic circuits:** The half-adder full adder. Parallel adders, IC parallel adders 2's complement addition and troubleshooting case studies. Asynchronous ripple

EEE-1222: Basic Electronics [3.0 credit, 45 Hours Lecture]

Introduction to Semiconductors: Semiconductors and their properties, Bonds in semiconductor, Classification- Intrinsic and extrinsic semiconductors. **Semiconductor Diodes and Special Purpose Diodes:** The pn junction- formation, properties and V-I characteristics, Basic constructions, characteristics, operations and uses of special diodes: Light-emitting diode (LED), Photo diode, Tunnel diode, Varactor diode, Shockley diode, Zener diode. **Bipolar Junction Transistors:** npn and pnp transistors, Amplifying and switching actions of transistor, Transistor characteristics in CB, CE & CC configurations, Operating point, Transistor load line analysis. **BJT Biasing:** Faithful amplification, Inherent variation of transistor parameters and thermal runway, Stabilization and stability factor, Methods of BJT biasing, Analysis and design of biasing circuits. **Single Stage Transistor Amplifier:** Single stage amplifier circuit, Phase reversal, dc and ac equivalent circuits, Load line analysis, Voltage gain and power gain, Classification of amplifiers, Amplifier equivalent circuits. **Field Effect Transistors:** Classification of FET , Construction, operation and characteristics of JFET, Transfer characteristics and Shockley's equation, Operation and characteristics curves of MOSFET, DC biasing of JFET. **Power Electronics:** Operations, characteristics and applications of industrial electronics devices: SCR (Silicon Controlled Rectifier), TRIAC, DIAC, UJT (Unijunction Transistor) **Feedback Techniques and Op-amps:** Concepts- negative and positive feedback, characteristics and gain with negative voltage and current feedback**,** Emitter Follower, Basic Op-amps- characteristics, inverting, non-inverting, integrators, differentiators, summing amplifiers. **Regulated Power Supply:** Voltage regulation, Rectifiers – operation and efficiency, half-wave and full-wave rectifiers, Ripple factor, Filter circuits – capacitor input filter, LC filter and □-filter, Voltage regulator circuits- zener diode and transistor voltage regulator. **Oscillators:** Theory of oscillation, Tuned collector oscillator, Wien Bridge oscillator, Colpitt's oscillator, Hartley oscillator, Phase shift oscillator, Quartz crystal oscillator.

MATH-1223: Linear Algebra [3.0 Credit, 45 Hours Lectures]

Vectors in Rn and Cn. Review of geometrie vectors on R2 and R3 space. vectors in Rn and Cn. Inner product. Norm and distance in Rn and Cn.
Matrices and Determinants: Notion of matrix. Types of matrices. Matrix operation of matrix Algebra Determinant function. Properties of determinants. Minors, Cofactors. expansion and evaluation of determiants. Elementary row and column operation and row-reduces echelon matrices Invertible matriees. Block matrices.
System of Linear Equations: Linear wquations. System of linear esquations (homogeneous and non-homogeneous) and determints for solving system of linear equations.
Vector Spaces: Notions of groups and fields. Abstract vector space. subspace. Sum and direct sum of sub spaces. Linear independence of vectors: basis and dimension of a vector spaces. Row and column space of a matrix: rank of matrices. Solution spaces of systems of linear equations.
Linear Transfomations: Linear transformation. Kernel and image of a nlinear transformation and their propertics. Matrix representation of linear tresformations. Change of bases.
Eigenvalues and Eigenvectors : Eigenvalues and eigenvectors. Diagonalization. caylcy Hamdon theorem. Applecation.

STAT-1224: Introduction to Statistics [3.0 Credits, 45 Hours Lectures]

Statistics – definition and scope: definitions of statistics – past and present, its nature and charateristics, population and sample, descriptive and inferential statistics, scope and applications of statistics, abuse of statistics, sources of statistical data, primary and secondary sources. Data collection tools, types, etc. Construction of questionnaire and other field problems of data collection. Types of data, cross sectional, longitudinal, follow-up and panel data.
Processing of data: measurement scales, variables, attributes, classification, characteristic and basis of classification, array formation, tabulation, different types of tables, frequency distribution.

Presentation of data: graphical presentation of data, details of different types of graphs and charts with their relative merits and dements, concept of explorative data analysis, stem-and-leaf plot, schematic plots, extremes and median, hinges, outlieres and 5 number summaries.
Characteristics of statistical data: measures of location, dispersion, skewness, kurtosis and their properties, moments box -and- whiskers plots, trimean, trimmed mean, interpretation of dat with these measures.
Correlation analysis: bivariate data, scatter diagram, simple correlation, rank correlation, correlation ratio, multiple and partial correlations, intraclass and biserial correlation.
Regression analysis: basic concept of regression, regression model, estimation of parameters (OLS method) in regression model, properties of estimators, interpreting the constants, some ideas of polynomial regression, 3-variable regression, estimation of parameters, standard error and other properties.
Association of attributes: concepts of independence, association and disassociation, contingency table, measure of association for nominal and data in contingency tables, partial association: different forms of correlation table.

Laboratory Courses

APE-1225: Engineering Drawing Lab [2.0 credit, 60 Hours]

Introduction to engineering graphics: construction of ellipse, parabola and hyperbola - cylindrical curves. Orthographic projections of points, lines and planes - axis inclined to one planes and inclined to both the planes. **Orthographic projections of solids:** Cylinder, cone, prism, pyramid and sphere positions and axis inclined to both the planes. Isomeric projections of lines, planes and simple solids. Conversion of orthographic views into isometric views and vice-versa.

EEE-1231: Digital Systems and VHDL Lab [1.5 Credit, 45 Hours]

Objectives: Laboratory assignements ranges from investigation of the properties of basic logic gates and flip-flops to the design of combinational and sequential circuits. Students experience the designing, impelementation, testing and troubleshooting of digital/logic circuits using small and medium-scale integrated circuits devices. Computer-Aided Design tools and hardware description programming language (VHDL) are used for design, simulation, and verification.

EEE-1232: Electronics Lab [1.5 Credit, 45 Hours]

Objectives: Laboratory classes are based on EEE-1222. The students will gain knowledge about single stage amplifier, regulated power supply etc. Several experiments will be performed with the operation amplifiers. The students will be introduced with differentiator, integrator, comparator etc. The students will construct and test the different passive and active filter circuits.

Third Semester

Major Courses

Theory Courses

CSE-2101: Data Structure [3.0 credits, 45 Hours Lecture]

Introduction to Data Structures, Purposes of data structure, Asymptotic Notation and Runtime Analysis of Algorithms, **Array:** Insertion, Deletion, Matrix representation of arrays, Multidimensional arrays, Pointers arrays, Record structures, Representation of records in memory; parallel arrays. Sparse matrices. Usefulness of sparse matrices. **Linked List:** Singly Linked Lists, Doubly Linked Lists and Circular Linked Lists. Basic Operations on Linked List (Insertion, Deletion and Traverse), Recursion, **Stack:** Basic Stack Operations (Push and Pop Operations), Infix, Postfix and Prefix Notation of Arithmetic Expressions, Conversions and Evaluations of Arithmetic Expressions Using Stack, **Recursion:** Direct and indirect recursion, Simulation of recursion, Depth of recursion, Removal of recursion. Towers of Hanoi using recursion. **Queue:** Basic Queue Operations (Insertion and Deletion), Circular Queue and Double-ended Queue, Searching – Sequential Searching, Binary Searching, **Basic Sorting:** Quick Sort, Merge Sort, Selection Sort, Inserting Sort, Radix Sort, Counting Sort, External Sort, **Binary Tree:** Binary tree representation**,** Traversal of Binary Tree (Inorder, Preorder and Postorder), Application of Binary Trees. Set Representation, Counting Binary Trees, **Binary Search Tree:** BST representation, Basic Operations

on BS(Creation, Insertion, Deletion and Traversing), **Heap** – Max and Min Heap, Operations on Heap(Insertion and Deletion), Heapsort, Priority Queue , **General Tree:** Representation of General Tree, Conversion Algorithm (General Tree to Binary Tree), **Balanced Tree:** Basic Concepts of 2-3 Tree, 2-3-4 Tree, AA Tree and AVL Tree, B-Tree and Basic Operations on B-Tree, Huffman Codes and Compression Algorithm, Disjoint Set and Operations and Disjoint set forests, **Graphs:** Graph Representation (Using Adjacency Matrix and Adjacency List), Basic Operations on Graph (Node/ Edge Insertion and Deletion), Traversing a Graph: Breadth-first Search, Depth-first Search. Topological Sorting. Single Source Shortest Paths : Dijkstra's Algorithm, All-Pairs Shortest Paths: Floyd Warshall 's Algorithm, Cycle Detection, **Hashing:** Hash Function and Overflow Handling, Open Hashing and Close Hashing, Linear Probing, Quadratic Probing, Double Hashing, randomize hash. **Files:** File queries sequential organization. Indexing Technique: Cylinder + surface indexing, Hash indexes trees, Indexing-Btrees, Tree indexing. **Case study**: (Based on a real problem) use of different data structures, their impacts on basic operations and comparisons.

CSE-2102: Object Oriented Programming [3.0 credits, 45 Hours Lecture]

Object Oriented programming overview, Definitions of Object Oriented programming, Object Oriented vs. procedural programming, An Introduction to Java, The Java programming environment, JDK overview, Memory management in java, **Fundamental programming structures in java:** primitive data types, control structure, methods, method abstraction and arrays, **Objects and Classes:** Fields, methods, and constructors, Access control, initialization and clean up, garbage collection, **Inheritance:** extending classes, subclass, super class, inheritance hierarchy, Overriding methods, dynamic method binding, abstract class, final method, final class, Packages, Interfaces & Inner classes, Java Collection Classes, **Exception and exception handling:** Exception handling fundamentals, Exception types, chained exception, creating own exception subclasses. **I/O:** I/O stream hierarchy, binary streams and character streams, **Graphical User Interface and Event Driven Programming:** Introduction to Swing and AWT, Component and Container and Layout, **Multithreading:** Thread basics, Creating a thread, Thread priorities, synchronization, Interthread communication, suspending, resuming and stopping threads, string class, Run time type identification, **Java applets:** interaction between the Web browser and applets, and conversion between applications and applets, Basics of JDBC and Socket Programming Java performance & Debugging in java. **Object-oriented Design Principles and examples:** Introduction to object-oriented design Principles and examples, Introduction to object-oriented design, UML.

CSE-2103: Computer Architecture [3.0 credits, 45 Hours Lecture]

Basic components of a computer and a microprocessor, types of components: registers, control section and ALU. **Digital Design Basics: Data representation**: Fixed and Floating point (IEEE754) number representations, **Arithmetic Circuits**: Adders, Subtractors & overflow, Magnitude Comparator, Other Basic Constructs: Decoder, Multiplexers etc. Flip-Flops and Latches, Register & Register Files, Sequential Circuits: Finite State Machine(FSM) representation, Serial Adder, Synchronous Counter Design, Timing Methodology. **Introduction to Processor Architecture:** The basic Accumulator based CPU: organization, instruction set, programming considerations, RISC & CISC Processors: Instruction Sets, Addressing Modes, Introduction to the Basic MIPS Instruction Set. **Performance Measurements** of processors. **Arithmetic Circuits:** Fast adders: Carry Look Ahead adders, Carry Save adder, Multipliers/Dividers: Booth's algorithm, restoring/non-restoring division, Array multipliers, Divider arrays. **Fixed Point ALUs**: Combinational and Sequential ALUs, ALU Expansion. **Floating Point Arithmetic & Floating point Units. Pipelined Processing:** Pipelined Multipliers, Carry Save Adders & Multipliers, Systolic Arrays. **Datapath & Control Design:** Single Cycle and Multi-cycle implementation of a Subset of the MIPS instruction set, the FSM control for datapath, Hardwired and Micro-programmed Control Design, Nanoprogrmming **Pipelined Datapath & Pipeline control**, Data and Control Hazards, Pipeline Performance. **Memory Organization:** Memory Devices, Random Access Memories, The Memory Hierarchy: Cost and Performance. **Cache Memory:** Associative & Direct mapping, Set associative Caches, performance measurements. **System Organization:** Buses, Bus arbitration, I/O Control, Interrupts and Direct Memory Access.

Laboratory Courses

CSE-2111: Data Structure Lab [1.5 credit, 45 Hours]

Objectives: Laboratory assignements will be based on Course CSE-2101. Students will be able to implement different data strcutures; like Array, String, Linked List, Tree, Graph in any programming language. They will be introduced with different sorting algorithms and advanced data structures.

CSE-2112: Object Oriented Programming Lab [1.5 credit, 45 Hours]

Objectives: Laboratory assignements will be based on Course CSE-2102. Students will be introduced with Object Oriented Programming in JAVA. They will be introduced with different advanced techniques of JAVA, like swing, socket programming, windows programming etc.

CSE-2113: Computer Architecture Lab [1.5 credit, 45 Hours]

Objectives: Upon successful completion of this lab, students should have gained knowledge about different types of adder, subtractor, multiplier circuits (fixed and floating point), able to implement a 4 (or more)-bit arithmetic logic unit (ALU), control unit and finally can design and implement a 4-bit microprocessor and computer system.

Minor Courses (For CSE Students)

Theory Courses

MTM-2121: Ordinary Differential Equation [3.0 credits, 45 Hours Lecture]

Ordinary differential equations and their solutions : Classification of differential equations. Solutions. Implicit solutions. Singular solutions. Intitial value problems. boundary vale problems. Basic existence and uniqueness theorems (statement and illustration only). Direction fields. phase line.
Solution of first order equations : Separable equations and equations reducible to this form. Linca, equations, exact equations, Special integrating factors, Substitutions and transformations.
Modeiling with first order differential equations : Constructions of differential equations as mathematical models (exponential growth and decay. beating and cooling , mixture of solutions, series circuit, logistic growth, chemical reaction, falling bodies). model solutions and interpretation of results. orthogonal and oblique trajectories.
Solutions of higher order linear differential equations : Linear differential operators. Basic theory of linear differential equations. Solution space of homogeneous systems. Reduction of order. Homegeneous linear equations with constant coefficient. Non homogeneous equation. Method of undetermined coefficiential. Variation of parameters. Euler-cauchy differential equations.
Modelling with second-order equations : Vibration of a mass on a spring, free and undamped motion; free and damped motion; forced motionl resonance phenomena ; electric problems ; motion of a rocker.

STAT-2122: Introduction to Probability [3.0 Credits, 45 Hours Lectures]

Elements of set theory: fundamentals of set, operations with set, laws of set.
Elements of probability: experiment, random experiment, sample spacem events, event space, union and intersection of events, different types of events.
Basic concepts of probability: different approaches of defining probability- classical, axiomatic, empirical and subjective, laws and theorems of probability, conditional probability, Bayes' theorem and its importance in statistics.
Random variable and its probability distribution: discrete and continuous random variables, probability mass function, probability density function, distribution function, function of random variable and its distribution, joint distribution, marginal and conditional distributions, independence of random variables.
Mathematical expectation: concept, expectations of sums and products of random variables, conditional expectation and conditional variance, moments and moment generating functions, cumulants and cumulant generating functions, relation between moments and cumulants, probability generating functions, characteristic function.
Some basic distributions: detailed study of bionomial, Poisson, normal, uniform, geometric, negative binomial, hypergeometric, exponential, gamma, beta distributions.

BUS-2123: Introduction to Business [2.0 Credits, 30 Hours Lecture]

The Business Enterprise: Foundation of Business & Economics, Forms of Business Ownership, Entrepreneurship, Franchising and Small Business, International Business.

The Environment of Business: Social responsibility and Business Ethics, Business Law and Government.
Management and Organization: Fundamentals of Management, Organization of Business, Managing production and operation.
Human Resources: Human Relations and Motivation, Managing Human Resources, Labor Management Relations.
Marketing: Marketing Strategies, Product & Price, Distribution and Promotion,
Financial Management: Money and Banking, Financial Management, Investment & Personal Finance, Risk Management and Insurance.
Accounting and Information Systems: Accounting Fundamentals, Computer and Management Information Systems.

Fourth Semester

Major Courses

Theory Courses

CSE-2201: Database System [3.0 credits, 45 Hours Lecture]

Introduction: General overview and purpose of DBMS, advantages, applications, common features and overall structure of the database. **Data modeling:** Relational model: structure of relational model, key constraints, referential integrity constraints, general constraints, relational algebra – fundamental, additional and extended operations, aggregate functions, outer joins and database modification using RA. ER model: entity and relationship sets, constraints – key, mapping cardinality and participation constraints, strong and weak entity sets, E-R diagram, class hierarchies, aggregation, conceptual database design with the ER model, converting ER to relational model, Object-relational data model: complex data types, structured types and inheritance, implementing O-R features. **Relational database design**: Features of good relational design, functional dependency theory - basic concept, uses, closure of a set of FDs, closure of attribute sets, canonical cover, algorithms for FDs, decomposition using FDs & its desirable properties, atomic domains and first normal form, BCNF and 3NF, multivalued dependencies and fourth normal form, decomposition algorithms for different normal forms, database design process. **Database application development:** Database Management Systems (DBMSs), SQL: data definition and data manipulation languages, integrity constraints, basic queries, nested and complex queries, modification of the database, Views: definition, update on views, cursors, Extending DBMS functionality: stored procedures, assertions and triggers, embedded and dynamic SQL, DBMS administration: DBA, users, privileges, security, performance, ODBC, JDBC, Web/Database architectures. **DBMS implementation technology:** Storage and file structure: different storage types, file and record organization, data dictionary storage, Indexing and hashing: basic concepts, ordered indices, B+-tree index files, B-tree index files, static & dynamic hashing, comparison of ordered indexing & hashing. **Query processing: o**verview, measures of query costs, selection operation, sorting, join operation, other operations, evaluation of expressions. Query optimization: Introduction, transformation of relational expressions, evaluation plan. **Transaction processing:** Transactions: concepts, ACID properties, transaction states, concurrent schedules, serializability - conflict and view serializability, recoverability, Concurrency control: lock-based concurrency control, two-phase locking, problems with locking, locking and starvation, deadlock – prevention, detection and recovery. **Introduction to modern database systems**: object-relational databases, deductive databases, spatial databases, temporal databases, multimedia databases, mobile databases and advanced relational databases.

CSE-2202: Microprocessor and Assembly Languages [3.0 credits, 45 Hours Lecture]

Introduction to Microprocessor: Evolution of Microprocessor, overview of microcomputer structure and operation, introduction to RISC and CISC processors. **8086 Microprocessor:** Introduction to 8086 microprocessor, 8086 architecture, registers and other components of 8086 system, 8086 instruction sets, constructing machine codes for 8086 instructions. 8086 system connections, timing and troubleshooting, 8086 interrupts and interrupt applications, Architecture of 8259A (priority interrupt controller), higher versions of 8086. **Pentium Microprocessor:**

Introduction to Pentium Microprocessor, pentium processor architecture, Register sets, cache, floating point operations, addressing modes, addressing, paging, Pentium process instruction set, opcode, interrupt, programming in Pentium machine, Hardware details of Pentium, Protected mode operations, branch prediction. **Assembly Language Programming:** Writing programs for use with an assembler, assembly language program development tools, implementing standard program structures in x86 (8086, i386 and Pentium) assembly language, testing and debugging an assembly language program, processing string, macros and procedures, assembler directives.

CSE-2203: Design and Analysis of Algorithms[3.0 credits, 45 Hours Lecture]

Introduction: The role of algorithms in computing. **Complexity Analysis:** Growth of a function, Asymptotic notation. **Recurrence Relation:** Methods to solve recurrences, Substitution method, Recursion tree method, Master method. **Graph related algorithms:** Breadth First search, Depth First Search, Topological sort, Strongly connected components, Euler Path, Articulation Point. **Shortest Path:** Dijkstra's shortest path algorithm, The Bellman-Ford algorithm for single source shortest path, The Floyd-Warshall algorithm for all-pair shortest path. **Divide and Conquer:** basic idea, properties, Applications of Divide and Conquer: Counting Inversions, Closest pair of points, etc. **Dynamic Programming:** Basic idea, Comparison with Divide and Conquer, Memorization. Application of Dynamic programming: Coin related problems, Longest Increasing Sequence (LIS), Longest Common Subsequence (LCS), 0/1 Knapsack problem, Matrix Chain Multiplication, etc. **Greedy method:** Elements of greedy method basic control structure, Comparison with dynamic programming and Divide and Conquer. Application of Greedy method: Minimum spanning tree: The algorithms of Prim & Kruskal, Job sequencing with deadline. **Backtracking:** Basic idea behind backtracking, control structure. Application of backtracking: Permutation & Combination Generation, Graph coloring problem, n-queens problems, Hamiltonian Cycle etc. Branch and Bound. **Network Flow:** Flow networks, The Ford-Fulkerson method, maximum bipartite matching, Maxflow-Mincut Theorem. Lower bound Theory for sorting**,** Exhaustive Search. **Number Theoretic Algorithms:** Extended Euclid's Theorem, Solving modular linear equations, The Chinese remainder theorem, The RSA public key encryption. **Computational Geometry related Algorithms:** Line segment intersection, Inclusion in a polygon, Finding Convex Hull: Grahams scan, Jervis's March. **String Matching Algorithms:** Naive string matching algorithm, String matching with finite automata, The Boyer-More algorithm for string matching, Knuth-Morris-Pratt algorithm. **NP-Completeness:** Polynomial time, Polynomial Time verification, NP-completeness and reducibility, NP-Completeness proofs, NP Complete problems. **Approximation Algorithms:** Introduction, Approximation Ratio, Approximation algorithms for: Vertex-Cover Problem, TSP Problem

Laboratory Courses

CSE-2211: Database Lab [1.5 credit, 45 Hours]

Objectives: Database labs are based on theory course CSE-2201. One large or several small database applications will be developed in the lab. Student will be given the ER model or description of a real problem. Based on the description they will design the ER model or convert the ER model to relational model using the features of relational database design(such as functional dependency, normalization etc) and finalize the relational model. After finalizing the relational model, student will go for implementation. In the implementation phases they should design the sql statements, stored procedure, trigger, views etc. whatever is required to complete the implementation. In the implementation phase should also be the main concern about query optimization, transaction, recovery and backup. Any database such as Oracle / mysql / PostGressSQL can be used.

CSE-2212: Microprocessor and Assembly Languages Lab[1.5 credit, 45 Hours]

Objectives: Laboratory classes are based on CSE-2202. Firstly, students will be introduced with Assembly Language and Assembler (NASM, TASM and/or MASM). Several experiments will be performed with the assemblers: I/O operations, Integer programming, String programming, Graphics programming, etc. Finally, they will be introduced with 8086 Toolkit (MDA 8086) and they will work in the kit mode. They will be familiar with all the components of an 8086 system. By using this toolkit they will be able to know the fundamentals of microcomputers from basic CPU instruction to practical applications. They will be able to control different types peripherals (LED, 7-segment display, Dot matrix display, etc) of the system by writing codes in machine language.

CSE-2213: Design and Analysis of Algorithms Lab [1.5 credits, 45 Hours]

Objectives: Based on course CSE-2203 student will be given various algorithmic problem based on different algorithm domains. By solving those problems students will gain knowledge on algorithmic techniques and their relative performances.

Minor Courses (For CSE Students)

Theory Courses

MTM-2221: Numerical Analysis [3.0 credits, 45 Hours Lecture]

Solutions of equation in one variable: bisection algorithm. Method of false position. Fixed point iteration, newton-Raphson method, Error Analysis iteration for iterative method, Accelerating limit of conver-gence.
Interpolation and polynomial approximation : Taylor polynomial, interpolation and lagrange polynomial. iterated interpolation. Extrapolation.
Differentiation and Inegration : Numercial differentiation. Richardson's extrapolation. Elements of Numericalinegrattion. Adaptive quadrature method Romberg's integration. Gaussian quadrature. Solutions of linear system, pivoting strategies, L U decomposition method.

ECO-2222: Economics [2.0 credits, 30 Hours Lecture]

Introduction: Definition, Microeconomics vs. macroeconomics, scope of economics, meaning of economic theory, some basic concepts- product, commodity, want, utility, consumption, factors of production.
Demand: Law of demand, factors determining demand, shifts in demand, demand functions, deriving demand curves, substitution and income effects, deriving aggregate demands, various concepts of demand elasticity and measurements, discussion on the method of estimating demand functions and demand functions and demand forecasting.
Supply: Law of supply and supply function, determination of supply, shifts in supply, elasticity of supply, market equilibrium.
Economic Theory of Consumer Behavior: reasons for consumption, Principle of diminishing marginal utility, indifference Curves, Budget Constraint, Utility Maximization and Consumer Equilibrium.
Consumer Demand: Change in Budget Constraints, Price Consumption Curve, Income Consumption Curve, Consumer Demand, market Demand, Engel Curve.
Production: Production functions, total, average and marginal products, law of diminishing marginal physical products, production isoquants, marginal rate of technical substitution (MRTS), optimal combination of inputs, expansion path, returns to scale, estimation of production function and estimation of cost function.
Cost: concepts of cost, short-run costs, relation between short-run costs and production, long run costs, economies and diseconomies of scale, relation between short run and long run costs, cost function and estimation of cost function.
Markets and Revenue: Meaning of market, different forms of market, concepts of total, average and marginal revenue, relation between average revenue and marginal revenue curves, relation between different revenues and elasticity's of demand, equilibrium of the firm.
Price and Output: Price and output determination under perfect competition, monopoly, monopolistic competition and oligopoly, profit maximization, price discrimination, plant shut down decision, barriers to entry.

SCO-2223: Sociology [2.0 credits, 30 Hours Lecture]

Introductory Sociology: Definition, scope , relationship with other disciplines.
Development of sociology : contributions of Auguste comte, Herbert Spencer ; Marx Emile Dufkheim Karl & Max Weber, theoretical perspectives.
Methods & Measures in Sociology: Scientific method, experiments, survey, participant observation, participatory techniques & historical sociology.
Culture, Beliefs & Values : Norms & sanctions, Symbols, language, subculture, counter-culture. Hegemony & resistance
Different Types of Societies : Hunting & gathering societies, horticultural societies, Agrarian societies & industrial societies. Primitive communism, slavery, feudalism, capitalism, socialism & communism.

Social interaction & Social Structure : Socialization : agencies of socialization, socialization & life cycle. Social Interaction, exchange reciprocity, status, role, groups & organizations.
Deviance & Social Control : Definition of deviance, theories of deviance Crime & Justice system ; agencies of social control
Social Inequality : Inequality, stratification & class Theories of stratification : Marx, weber, Davis & Moore Gender inequality, age & inequality, social mobility.
Family, Education & religion : Forms & functions of Family, Education of Economic & political system, Religioms Belifs & Rituals.
Population & Environment : Global Economy, Rural society R urbanization.
Dynamics of social life : Collective behavior & social movement . Social change : factors of social change, theories of social change, functionalism, conflict, modernization dependency, world system globalization.

Fifth Semester

Major Courses

Theory Courses

CSE-3101: Peripheral and Interfacing [3.0 credits, 45 Hours Lecture]

INTERFACING: Interfacing basics: Peripheral devices, adapters, Data highway, I/O operations. Interrupts basics, types, priority etc. and the interrupt controllers- Daisy chain configuration, 8259A. DMA basics and the 8237 DMA controller. Buses: AGP, PCI and PCI express, USB, SCSI. ***Digital Interfacing:*** Digital Interfacing basics and the Programmable Parallel Port 8255A. Centronics Standard for Parallel Printer Interfacing, Keyboard and Alpha-numeric Display Interfacing. Keyboard and Alpha-numeric Display Interfacing using 8279 .high power devices. Interfacing microcomputer ports to stepper motor and high power devices. Optical motor shaft encoders. Analog Interfacing: D/A (simple and R-2R ladder circuits) and A/D (parallel, successive approximation and Dual-slope circuits) converters, properties and interfacing, interfacing with different sensors. **PERIPHERALS DEVICES:** Different types of sensors and transducers. Input Devices: Different types of Mouse, Joystick, Scanner, Light, Pen, Touch Screen, OMR, OCR, Barcode Reader. Magnetic and Optical disk storage. Keyboard switches, Light Emitting Diodes, CRT and LCD displays, Laser printers: organization, working principle and properties.

CSE-3102: Data & Telecommunications [3.0 credits, 45 Hours Lecture]

Introduction: Communication model, data communication tasks, data communication network standards and organizations. Protocol architecture, communications between layers, peer to peer communication between remote layers, service access points, service primitives and communication between adjacent layers, encapsulation of PDUs, addition of headers on transmission; removal on reception, segmentation & reassembly by protocol layers, introduction to TCP/IP model and OSI models. Definition of a communications network, types of network, understanding of operation and examples of use-point-to-point connections, circuit-switched networks, message-switched networks, packet-switched networks. types of equipment-end systems, intermediate systems (IS), types of communication - client and server communication, broadcast, unicast and multicast modes, types of packet-switched network-wide area networks (WANs), Internet service providers (ISPs), local area networks (LANs). 2. Physical Layer: Signal: Analog and digital data transmission, spectrum and bandwidth, transmission impairments, data rate and channel capacity. Transmission Medium: Characteristics and applications of various types of guided medium. Wireless Transmission: Characteristics and applications of wireless transmission-terrestrial and satellite microwave, radio waves, propagation mechanism, free space propagation, land propagation, path loss, slow fading, fast fading, delay spread, inter symbol interference, VSAT. Digital transmission: Line coding techniques- NRZ, RZ, Manchester, and differential Manchester encoding, AMI, Block coding, analog to digital conversion based on PCM, delta modulation, etc. Analog transmission: ASK, FSK, PSK, QPSK, QAM encodings, AM, PM, FM, etc. Data Transmission: Synchronous and asynchronous data transmission techniques, interfacing and V.24BIA-232-F, Multiplexing: FDM, international FDM carrier standards, synchronous TDM, international TDM carrier standards, statistical time division multiplexing. Spread Spectrum: Frequency hopping spread spectrum, direct sequence spread spectrum, code division multiple access. High speed digital access: DSL, SONET, SDH, etc. 3. Data Link Layer: Error Detection and Correction; parity check, CRC, forward error correction technique, linear block code, hamming code, etc. Data Link Control: Line configurations, flow control and error control techniques- sliding window, stop and wait ARQ, selective reject ARQ and HDLC protocols. Local Area Network: Topologies and transmission media, LAN protocol rchitecture, bridges, repeaters, hub, switches, routers, Ethernet, Token ring, Fiber channel, Introduction to wireless LAN. 4. Data Communication and Network: Circuit switching network, packet switching network, comparison of circuit and packet switching, X.25 etc., Introduction to telecommunication structure of public telephone system and its operation simplex, duplex, half-duplex, full-duplex communication, etc.

CSE-3103: Software Engineering [3.0 credits, 45 Hours Lecture]

The Product and the Process: the Product, the Process. **Managing Software Projects:** Project Management Concepts, Software Process and Project Metrics, Software Project Planning, Risk Analysis and Management, Project Scheduling and Tracking, Software Quality Assurance, Software Configuration Management. **Conventional Methods for Software Engineering**: System

Engineering, Analysis Concepts and Principles, Analysis Modeling, Design Concepts and Principles, Architectural Design, User Interface Design, Component-Level Design, Software Testing Techniques, Software Testing Strategies, Technical Metrics for Software. **Object Oriented Software Engineering**: Object-Oriented Concepts and Principles, Object-Oriented Analysis, Object-Oriented Design, Object-Oriented Testing, Technical Metrics for Object-Oriented Systems. **Advanced Topics in Software Engineering**: Formal Methods, Cleanroom Software Engineering, Component-Based Software Engineering, Client/Server Software Engineering, Web Engineering, Reengineering, Computer-Aided Software Engineering.

CSE-3104: Operating System [3.0 credits, 45 Hours Lecture]

Introduction: Operating system overview, computer system structure, structure and components of an operating system. **System system calls:** class of system calls and description. **MIPS R3000 processor:** overview and programming model, Exceptions, MIPS system call, system161. **Process and threads:** process and thread model, process and thread creation and termination, user and kernel level thread, scheduling, scheduling algorithms, dispatcher, context switch, real time scheduling, OS/161 switch. **Concurrency and synchronization:** IPC and inter-thread communication, critical region, critical section problems and solutions. **Resource management:** introduction to deadlock, ostrich algorithm, deadlock detection and recovery, deadlock avoidance, deadlock prevention, starvation. **File management:** File Naming and structure, file access and attributes, system calls, file organization: OS and user perspective view of file, memory mapped file, file directories organization, **case study:** UNIX file access permissions and rights. **File System Implementation:** implementing file, allocation strategy, method of allocation, directory implementation, UNIX i-node, block management, quota. **UNIX file management:** Berkeley fast file system (FFS) Ext2fs, Ext3fs, superblocks, partition, Ext2fs and Ext3fs Directories, supporting multiple filesystem, OS/161 VFS, UNIX buffer cache, filesystem consistency. **Memory management:** basic memory management, fixed and dynamic partition, virtual memory, segmentation, paging and swapping, MMU. **Virtual memory management:** paging, page table structure, page replacement, TLB, R3000 TLB and address space, R3000 TLB handling, exception vector, demand paging and segmentation, thrashing and performance. **I/O management:** I/O Devices, I/O Bus architecture and controller, interrupts, DMA, programmed I/O, Evolution of I/O functions, I/O software layer, Device drivers, Device independent I/O software, buffering. **Disk I/O management:** structure, performance, low-level disk formating, Disk arm scheduling algorithm, error handling, stable storage. **Security:** threats, data security, intruders, data loss, user authentication, password security and salt, one way function, authentication using physical object, software threats, Trojan Horses, spoofing, trap doors, viruses, anti-virus approach and technique, snadbox implementation, security policy and mechanism, protection mechanism, protection domain, Access Matrix, access control list, capabilities. **RAID:** RAID 0-5, HP auto RAID. **Multiprocessor system:** UMA MP, NUMA, SMP- structure and programming model, synchronization, scheduling.

Laboratory Courses

CSE-3111: Peripheral and Interfacing Lab [1.5 credits, 45 Hours]

Objectives: The key objective of the course is to introduce the students with different peripheral devices (LED, 7-segment display, 16x2 LCD display, stepper motor, DC motor, survo motor, etc), Sensors (Temperature sensor,light sensors, etc) and interfacing. Beside that, students will be introduced how those devices are interfaced and controlled from computer. After completing the course, students will be able to control any peripheral devices from computer through computer's parallel port. Students will be introduced with various micro controllers (PIC 16F84,ATMEL etc) and they will be able to design micro controller based small embedded systems.

CSE-3112: Data and Telecommunications lab [1.5 credit, 45 Hours]

Objectives: Upon successful completion of this laboratory, students should have knowledge about various communication protocols in physical layers, be able to identify different transmission media based on their characteristics and can apply different signal encoding schemes and analyze their performance. They can handle different error detection and error control mechanism as well as different flow control mechanism and quantitatively analyze their performance. Having experience on serial communication, they can also implement the NULL modem communication. They can also use different types of multiplexing in a real or simulated environment.

CSE-3113: Operating System Lab [1.5 credit, 45 Hours]

Objectives: Lab based on operating system course. Source code of OS161 operating system and required tools developed by Harvard University, based on R3000 architecture will be used in the lab. Student will be asked to add operating system module such as memory management, system call, file system, drivers etc. In the lab for such modules problems will defined elaborately. The laboratory also train student in debugging using gdb based on R3000.

Minor Courses (For CSE Students)

Theory Courses

ENG-3221: Professinal English [2.0 credits, 30 Hours Lecture]

This course adopts an integrative approach to teaching the four basic skills: speaking, listening, reading and writing. Special emphasis will be given to the development of reading and writing skills. To ensure maximum benefit from this course, 30% of the total marks will be allotted to class work in reading and writing. **Speaking:** Students will focus on developing speaking which will include strategies for communication and an acquaintance with phonetics. Effective oral presentation. Tasks will include making statements, requests, inquiries, disagreeing, complaining and apologizing, discussing, and other oral presentations. **Listening:** Students will practice listening to spoken English and taking useful notes. **Reading:** Extracts from literary and general essays will be used to develop comprehension as well as an understanding of the nature of literary communication. Students will develop the following reading strategies: **Grammar in Use:** While grammar will generally be taught in context, some attention to grammar may be necessary a this stage. The following aspects may be taught: articles, verb patterns, sentence combining-subordination and coordination, conditional sentences, the infinitive, gerund, and participle, subject-verb agreement. **Writing:** Paragraph, précis and analytical writings, writing on current affairs, Scientific writing. **Commercial Correspondences:** Defining context, feedback and semantic gap. Different types of commercial and business letter writing, tender-notice and pre-qualification notice writing. Writing of different types of reports on specific topics.

GEN-3222: Bangladesh Studies [2.0 credits, 30 Hours Lecture]

Introduction: Historical Background of Bangladesh, Ancient Bengal, the Medieval Bengal, Moghal Period, British rule in Bangladesh, Pakistan Period, Emergence of Bangladesh.

Cultural development: Development of Bengali cinema, Drama, Literature movement, Socio-cultural development in recent Bangladesh.

Liberation War and Emergence of Bangladesh: Primary stage of liberation, language movement, Declaration of Independence, Freedom fighting, Genocides during Liberation period, Freedom fighters and their contributions for Independence, Birshresto and other award winners during Liberation time, Day of Independence and Bijoy Dibash, Rule of Foreign for Independence of Bangladesh, Legislature, Judiciary system.

Structure of activity of government, constitution of Bangladesh, Reconstructions and rehabilitations works, Economic constrains during early days, Rule of Donors to activate country's economic and other development activities.

Geophysical condition: Position of Bangladesh in Global map, Current District and Thana administrations and locations, Rivers in Bangladesh and their importance, flood situation and waterflow system.

Industrial Development: Introduction of Industries, structure of Industries, success and failure history, development of manufacturing sector, export development, developing agencies, Industrial export-import policies of Bangladesh.

Educational Development: Education structure in primitive and present situation, educational policies, crisis of implementation, literacy rate, current situation of educational environment in

Bangladesh, human resource development trends and manpower export from Bangladesh, computer literacy.

Rural and Urban Development: Rural situation during early days and latest condition, migration of rural people to urban area, economic and other gaps of rural and urban peoples, rural and urban communications, minimization gaps of rural and urban peoples, sanitation system, health care and education level, economic and manufacturing levels and life style of urban and rural area, religious activities in Bangladesh and the moral values.

Economic activities: Major economic sectors, trends of economic growth, recent development in various sectors, rule agricultural sector, RMG sector, leather sector, frozen foods and other potential sectors in Bangladesh, transport and port facilities.

Sixth Semester

Major Courses

Theory Courses

CSE-3201: Software Design Pattern [3.0 credits, 45 Hours Lecture]

Introduction to OO Software, Approaches to OO Design, GOF design pattern and their classification. Designing with CRC cards, CRC modeling examples, finding the classes from CRC cards, introduction to C++; template and factory method design pattern structure, template and factory method in C++, Iterator design pattern: polymorphic iterator, structure, implementation; C++ standard library: string, IO, container such as vector, list, queue, stack, deque, priority_queue, set, multiset, map, multimap. Class diagram in UML: Class, Class notation, attributes, operations, relationship such as association, generalisation, dependency, realisation , constraints. C++ pointer and references, C++ storage allocation, C++ operator, C++ function pointer, C++ header file definition rules, header file rules, Class declaration, const and inline methods, constructor, overloaded constructor and default arguments, copy constructor, assignment operator, destructor, operator overloading, new, delete. Inheritance, polymorphism, dynamic binding and virtual function, Abstract class and Interfaces, Design pattern: Decorator, Composite, Bridge, Observer structure and implementation. Iteration with composite. Structure and implementation of Multiple inheritance, Adaptor, Abstract factory and Visitor Design pattern. Templates in C++ , Design By Contract and Assertions. Template and traits. Structure and implementation of Singleton, Command , Interpreter, Mediator , State, Strategy, Chain of Responsibility design pattern. Rest GOF design pattern such as Behavioural (Memento), Structural (Flyweight), Proxy , Builder , Prototype. Exceptions in C++, Structured Exception handling, Error handling, exception hierarchy, catching exception, Exception handling strategies etc. Issues for design of an Standard library, STL container design and problems, Standard library organisation, generic algorithms, iterator traits template, alocators. UML to code. Name visibility and namespace in C++, Generic programming in C++, Object and threads, Synchronisation Wrappers. Future research direction.

CSE-3202: Computer Networking [3.0 credits, 45 Hours Lecture]

Introduction to Computer Networks: Internet Architecture, Circuit and Packet Switching, Access Systems. Delay Calculation. Protocol Layers, **Application Layer**: Principles of Application Layers, HTTP, FTP, E-mail, DNS, SNMP, Socket Programming, P2P Networks. **Transport Layer**: Introduction to services, Multiplexing, UDP, Reliable data delivery, TCP, Congestion Control. **Network Layer**: Virtual Circuits, IP, Addressing, Router Internals, Routing Algorithms. **Data Link Layer**: Services, Error detection, Multiple Access Protocols, Link layer addressing, Ethernet, Switches, PPP. **Wireless and Mobile Networks:** Wireless characteristics, CDMA, Cellular Networks, Mobility. **Network Security:** Symmetric and Public Key Cryptography, Authentication, Digital Signatures, Key Distribution and certification, Firewalls.

CSE-3203: Finite language, Automata and Computation [3.0 credits, 45 Hours Lecture]

Finite Automata(FA): Deterministic FA (DFA) and Non-Deterministic (NFA), Equivalence and Conversion of NFA to DFA (the Subset Construction Algorithm). Regular Expressions, Identies for regular expressions, Conversion between regular expressions and NFA & DFA, FA with output: Mealy machines and Moore machines. Properties of Regular Languages: Pumping lemma & its

application, Closure properties, Decision Algorithms, Minimization of DFAs. Grammars: The Chomsky hierarchy, Regular grammars and regular languages, Context Free Grammars (CFGs) and Languages (CFLs), Reduction of CFLs, Normal forms CNF and GNF. Push Down Automata (PDA), DPDAs, Equivalence of PDAs & CFLs. Properties of CFLs: pumping lemma, decision algorithms, CYK algorithm. Turing Machines, Computation with Turing Machines, Turing computable functions and partial and total recursive functions. Equivalence of Unrestricted Grammars and Turing Machines and Equivalence of Context sensitive grammars and Linear Bound Automata. Recursive and Recursively Enumerable languges and their properties, Undecidability – Diagonalization method, Halting problem, undecidable problems from language theory, Reducibility, Self reference and the Recursive theorem.

CSE-3204: System Programming [3.0 credits, 45 Hours Lecture]

Systems programming concepts, general machine structures, machine and assembly language, concepts of translation oriented system programs; **Kernel:** General kernel responsibilities, kernel organization, kernel compiling and installing, kernel's role at system startup, process creation and termination, Process execution, ELF format, inter process communication, signal handling, Memory management: page frame management, memory area management, kernel memory management, VFS: VFS data structures, File system handling, Generic characteristics of Ext3 file system, **Interrupt:** Interrupt handlers, registering an interrupt handler, writing an interrupt handler. **System Calls:** system call handler, system call implementation, entering and exiting a system call. **Linux Module Programming**: linux device driver, Building, installing and loading modules, I/O architecture, the device driver model, device files, character device driver, block device driver, working with USB device driver. **Assembler, Linker & Loaders:** Basic Assembler Functions, Machine Dependent Assembler features, Machine Independent Assembler Features, Assembler Design Options - One pass assembler and multipass assembler, Basic Loader Functions, Machine Dependent Loader Features, Machine Independent Loader Features, Linkage Editors, Dynamic Linking, Bootstrap Loader, Basic Macro Processor Functions.

CSE-3205: Mathematics for Computer Science [3.0 credits, 45 Hours Lecture]

Two-dimensional geometry: Cartesian and homogeneous coordinate system, Coordinates in two dimension, Transformations of coordinates, Reduction of second degree equations to standard forms. Paris of straight lines, Identifications of conics. Equations of conics in polar coordinates. **Three dimensional geometry:** Coordinates in three dimensions, geometric and coordinate Transformations, Planes, straight-lines and conicoids (basic definitions and properties only). **Vector geometry:** Vectors in plane and space. Algebra of vectors, scalar and vector products. Aplications to Geometry. **Fourier Series:** Fourier sine and cosine series. Properties of Fourier series. Operations on Fourier series. Complex from. **Laplace transforms:** Basic definitions and properties, Existence theorem, Laplace transforms of periodic functions. Transforms of convolutions. Inverse transform. Use of Laplace transforms in solving initial value problems. Stochastic procedure, Markov chain model, Basic queuing model.

Laboratory Courses

CSE-3212: Computer Networking Lab [1.5 credits, 45 Hours]

Objectives: Based networking course. Starting with application layer students will configure different application layer services and examine their messaging techniques. Students will be asked to develop some services based on tranport layer (TCP, UDP).

CSE-3213: System programming Lab [1.5 credits, 45 Hours]

Objectives: Student will be asked to develope some system tools based on various system call. Linux module programming will be an important part of this lab. They will be asked to develope device driver for Linux as a Linux module.

CSE -3214: Software Design pattern Lab [1.5 credits, 45 Hours]

Objectives: Based on C++/JAVA student will be asked to develope a large project. To design such project student should first use CRC for determining the classes. After discussion and finalize student should develop UML class diagram for design. After finalize the design student will be asked to implement step by steps. Teacher have the flexibility to redesing the lab in other ways.

Seventh Semester

Major Courses

Theory Courses

CSE-4101: Artificial Intelligence [3.0 Credits, 45 Hours lectures]

Overview of Al, AI programming language: prolog, Environment Types, Agent Types, Agent Model, Reactive Agents, Perception: Neurons – Biological and Artificial, Perceptron Learning, Linear Separability, Multi-Layer Networks,Problem solving and searching: 8-puzzle problem, N-queen problem, robotic arm assembly, general search, Review of Un-Informed Search Strategies: bredth first search, uniform cost search, depth-first search, iterative deepening, bidirectional search; Informed search algorithms: best-first search, A* search, Beam search, Huristic searching, Memory Bounded Search (e.g. IDA*, RBFS, SMA*); Local Searches: Hill Climbing, Simulated Annealing, Constraint Satisfaction Problems. Genetic Algorithm. Motion planning: motion planning search, configuration, action and obstacle, Road map, Game Playing: motivation, minimax search, resource limits and heuristic evaluation, α-β pruning, stochastic games, partially observable games, continuous, embodied games, Neural Networks: Multi-Layer Neural Networks, Backpropagation, Variations on Backprop, Cross Entropy, Weight Decay, Momentum, Training Tips, Applications ALVINN, TD-Gammon, Machine Learning: Supervised Learning, Decision Trees, Reinforcement Learning, Exploration vs. Exploitation, Q-Learning, Temporal Difference learning, General concepts of knowledge, Knowledge representation, frame problem, representing time, events and actions, Utility and MEU, Value of Information, Decision Networks, Value Iteration algorithm, Partially Observable Markov Decision Process, Introduction to Game Theory. Logical Agent: Knowledge-based agents, Logic in general—models and entailment, Propositional (Boolean) logic, Equivalence, validity, satisfiability, Inference rules and theorem proving -- forward chaining, backward chaining, resolution, First order Logic: Universal and Existential Quantifiers, Keeping Track of Change, Inference in first order logic Planning, Situation Calculus, Belief Networks Probabilistic Reasoning, Hidden Markov Model and the Dynamic Bayesian Network. Logical Inference, Communication, Robotics

CSE-4102: Compiler Design and Construction

[3.0 Credits, 45 Hours lectures]

Phases of a compiler, front and back end of a compiler. **Lexical Analysis:** regular expressions and regular languages, Finite Automata based pattern matching, Input buffering techniques, **Syntax Analysis:** Context free grammars, Top-down parsing: LL(1), Recursive Descent parsing, Bottom-up parsing ; LR(0), SLR(1), LR (1), LALR(1) parsing, syntactic error recovery, **Syntax directed Definitions and Translation**, attributes evaluation, **Symbol Tables, Type expressions and type checking, Runtime structures**- Activation Records, Static and Dynamic Scoping. **Intermediate Representation:** Abstract syntax trees, 3-address code, etc. Generation of 3-address codes – Syntax directed translation for Declarations, Assignment statements, Boolean expression, switch/case statements, Flow of Control statements, etc. use of Backpatching. **Target Code generation**. **Optimization**: Control flow graphs, **Data flow Analysis**: Reaching definitions and Live-variable analysis and Def-use & use-def chains, Available Expression analysis and Global common sub expression elimination, Dominators, Loops in control flow graphs, Loop invariants and code motion, Elimination of Induction variables, Partial redundancy elimination, constant folding and constant propagation, copy propagation, Dealing with Alaiasing, Interprocedural Dataflow Analysis, Introduction to **Static Single-Assignment (SSA)form**; **Global Register allocation** by graph coloring, **Instruction Scheduling**: list scheduling, **Optimization for memory hierarchies**.

CSE-4103: Computer Graphics [3.0 Credits, 45 Hours lectures]

Standard Graphics Primitives, Graphical User Interface; Graphics Hardware Display devices, Raster refresh graphics display, Use of frame buffer and look up table Coordinate convention Device coordinate and wild coordinate system. Vector graphics and raster graphics system. Scan conversiton algorithms: Mid-point Line, Circle and ellipes Creation Algorithms. Slope independent line drawing usiing mid-point line algorithm. Polygons: Difference type of polygons, polygon filling, triangulation, polygon filling algorithm. Windowing and Clipping: Window Viewpoint, Zooming, panning, line, text and polygon, clipping algorithms. Transformation: Homogeneous coordination, Transformation in 3D, Transformation matrices, translation, rotation, scaling. Projection: Parallel and perspective, standard projection matrices. Hidden Surface removal: Painter's algorithm, Z-Buffering, Visible surface ray-tracing algorithm. Illumination and Shading: Light Models, Ambient light, diffuse and specular reflection, light attenuations, Goraud and Phong shading, Recursive Ray Tracing.

Monochorome and colored light: monochrome light, additive and suntractive light, Colored light-RGB, CMY, YIQ, HSV and HLS color model. Image File Format: PPM file, BMP file. Representing curves and surfaces: Polygonal surfaces, Parametric Cubic Curves- Hermite, Bezier and B-spline curces, parametric bi-cubic surfaces: bicubic splines. Introduction to Graphics Programming. The nature of computer animation.

CSE-4104: E-commerce and Web Engineering [3.0 credits, 45 Hours Lecture]

Introduction to Internet programming. E-commerce, E-Commerce Revolution, Understanding E-commerce Organizing Themes. The Internet and World Wide Web: E-commerce Infrastructure. E-Commerce System Models and Concepts : B2B, B2C, C2C. The Internet: Technology, background. Building an E-Commerce Application: A systematic approach. Choosing server software. Choosing the hardware for an E-commerce site. E-commerce Application Development: XML and XML parsing Methods, XFORMS and XHTML. Presentation layer Development (Servlet, JSP), Business Logic Layer Development(EJB), Data Layer Development(JDBC), Web Application Design pattern (MVC and other). Personalization, Testing and Debugging, Application to Application communication Protocols: SOAP, WSDL, UDDI, RMI, DCOM, CORBA etc. Security and Encryption: Security, privacy and payment. The E-commerce Security Environment, Security Model. Network-level Security: SSL, Application-level Security. SQL-injection, Form modification, cross site scripting, Privacy: P3P, Policies, Procedures; and Laws. E-commerce Payment Systems. E-Commerce Application infrastructure: J2EE, Net and Web services.

Laboratory Courses

CSE-4111: Artificial Intelligent Lab [1.5 Credits, 45 Hours]

Objectives: Laboratory assignments will be based on the Course CSE-4101. Lab assignments includes, basic AI technologies and algorithms using non procedural programming languages, e.g., LIPS and/or PROLOG.

CSE-4112: Compiler Lab [1.5 Credits, 45 Hours]

Objectives: Laboratory assignments will be based on the Course CSE-4102. Lab assignments will include but not limited to: design of simple lexical analyser, design of recursive descent parser, use of the compliler design tools e.g. LEX and YACC to implement different syntax directed translations and designing and implementing a complete compiler, for target machines such as x86 or MIPS like machines, for some given grammar of a simple but complete language. Simple optimizations techniques should be included.

CSE-4113: Computer Graphics Lab [1.5 Credits, 45 Hours]

Objectives: Laboratory problems are designed based on CSE-4103 computer graphics course. The main target of this lab is to make the students familier with the underlying phenomenon of graphical rendering, which will help them to be a good graphics engineer. For rendering is done using the basic concept of polygon filling, z-buffering, shading and scan conversion algorithm. Help from any API is taken for rendering and animation.

CSE-4114: E-commerce and Web Engineering Lab [1.5 Credits, 45 Hours]

Objectives: Using three tire MVC model and based on J2EE application Plateform student will be asked to develope E-Commerce (internet application) based projects. Usually a large project will be divided into smaller parts and asked to implement step by step in J2EE application plateform. Student should develope a example project at the end.

Eighth Semester

Major Courses

Theory Courses

CSE-4201: Distributed Systems [3.0 Credits, 45 Hours lectures]

Introduction to Parallel and Distributed Systems: Architecture, Challenges, principle and paradigm, Middleware: Introduction to Erlang, Communication: synchronous and asynchronous communication abstraction and model, message passing and shared memory. Replication & Consistency: Control replication, data replication, consistency model and protocols. Distributed Shared Memory: Design issue, Implementation issue, consistency issue, Shared Memory model, MPI, LINDA, ORCA, case study: TradMark, JACKAL. Distributed Objects: introduction, remote objects, CORBA, Distributed Shared object, Globe. Synchronization & Coordination: Distributed algorithms, time and clocks, Local state, Global State, consistency protocols, coordination elections, distributed transactions management. Fault Tolerance: Failure model, Faults, Process Resilience, reliable communication, Recovery, checkpoints and checkpoint algorithms, Rollback recovery algorithms, Security: Threats and attacks, policy and mechanism, Design issue, design of cryptographic algorithms, cryptographic protocols, key distribution, authentication, secure communication, auditing. Naming: Basic concept, Naming Services, DNS, Attribute based naming, X.500 and LDAP, Distributed File Systems: Client perspective, Server perspective, NFS, Coda, Google File System(GFS). Parallel Programming: parallel computing, parallel programming structure, PlanetLab, Grid: Grid model, Grid Middleware, Globus toolkit, PlanetLab Overview.

CSE-4202: Advanced Database [3.0 Credits, 45 Hours lectures]

Introduction to machine learning and data mining, Designing a learning system, perspective issues in machine learning, Concept of learning and the general to specific Ordering: induction learning hypothesis, Find-S, version space and candidate elimination algorithms, List-then-elimination algorithms, A biased hypothesis space, unbiased hypothesis space, decision tree, Artificial Neural networks, Multilayer networks and back propagation algorithms, Recurrent network, Evaluation hypothesis, Bayesian learning, Naive bays classifier, Gibbs algorithms, Bayesian belief Networks, EM algorithms, Computational learning theory, probability learning theory, sample complexity finite hypothesis space, sample complexity infinite hypothesis space, Mistake bound model of learning, Instance based learning, K-nearest neighbor learning, Genetic algorithms, Learning sets rules, Analytical learning, Combining inductive and Analytical learning, Reinforcement learning, SVM, Boasting, Clustering, training and testing, cross validation, prediction performance, Data mining tools.

Laboratory Courses

CSE-4211: Distributed Systems Lab [1.5 Credits, 45 Hours]

Objectives: The lab problems will be designed based on Distributed system theoritical courses. Objectives of this laboratory is to gain keen knowledge on various componets of middlewire design and programming. Laboratory problems should be developed to implement consistency model, transaction management and various other services based on the theoretical course. Using middle wire student will solve the problem using parallel programming techniques.

CSE-4212: Advanced Database Lab [1.5 Credits, 45 Hours]

CSE-4251: Project/Industry Attachment [5 Credits, 150 Hours]

Optional Courses

CSE-4261: Simulation and Modeling [3.0 Credits, 45 Hours lectures]

Systems- System environment and System components; **System models and Simulation** - types of System model and simulation – Discrete and Continues, Static and Dynamic, Deterministic and Stochastic; **Discrete Event driven simulation** – Components and Organization, Event Scheduling/ Time Advance approach and Process Interaction approach, Event lists and List processing. Basics of Parallel and Distributed Simulation; **Simulation Languages and Packages** – **Process approach to simulation**, application oriented and general purpose simulation language and software: GPSS, SSF API for JAVA and C++, Arena, Extend, SIMUL8 etc. **Probability and Statistical concepts in simulation** – Random variable and its probability distributions, Stochastic process – e.g. Poisson process, Non stationary Poisson process, Compound Poisson process and their properties. Basics of Estimation, Hypothesis tests: Confidence Intervals and t-distribution. **Queuing Models** – Queuing Systems, Queuing behavior (e.g. balk, renege and jockey) and Queuing disciplines, Arrival process, Inter-arrival time distributions and Service time distributions. Long run measures of performance, Little's formula, Analysis of different Single-server and Multi-Server queuing systems, Queuing networks and their analysis, Jackson's theorem; **Inverse transformation technique for generating random variates**, other techniques: Acceptance–Rejection, Special properties, Convolution etc. **Random Number generation**: Linear Congruent method, composite generators, Random number streams; Testing for random numbers – frequency test and test for autocorrelation; **Input modeling**: identifying input model with data – Histograms, Q-Q plots, selecting the family of distribution, parameter estimation and Goodness-of-fit tests; selecting input model without data, multivariate and time-series input models, Models of arrival processes. **Verification and Validation of simulation models** – face validity, validation of model assumptions, input-out transformation and input output validation using historical input data. **Output data analysis** – types of simulation with respect to output analysis, stochastic nature of output data, measure of performance and their estimators, output analysis for terminating the simulation and for steady state simulations. Techniques for comparison of alternative system design through simulation. **Simulation and queuing models of computer systems**: CPU, memory simulation; Traffic modeling and simulation of computer networks and network protocols, using queuing network analysis.

CSE-4262: Cryptography and Network Security [3.0 Credits, 45 Hours lectures]

Overview, Symmetric Ciphers, Block Ciphers and the Data Encryption Standard, Mathematical Tools for Cryptography: Substitutions and Permutations, Modular Arithmetic, Euclid's Algorithm, Finite Fields, Polynomial Arithmetic, Discrete Logarithms. Classical Encryption Techniques, Conventional Symmetric Encryption Algorithms, Modem Symmetric Encryption Algorithms, Advanced Encryption Standard, Contemporary Symmetric Ciphers Confidentiality Using Symmetric Encryption Public, Key- Encryption, Hash Functions and Message Digests. Introduction to Number Theory, Public-Key Cryptography and RSA, Key Management; Other Pubic-Key Cryptosystems, Message Authentication and Hash Functions, Hash Algorithms, Digital Signatures, Certificates, User authentication: Digital Signature Standard (DSS and DSA), Security Handshake Pitfalls Protocols, Network. Security Practice, Authentication Application Electronic Mail Security, IP Security, Web Security, Electronic Commerce Security, System Security, Intruders, Malicious Software, Firewalls.

CSE-4263: Digital Signal Processing [3.0 Credits, 45 Hours lectures]

Signal, system and processing, advantages and limitations of DSP, components of DSP, classification of signals, concept of frequency, sampling theorem, Nyquist rate, aliasing, quantization, coding, classifications of discrete time signal and systems, implementation of discrete time systems, analysis of LTI system, causality and stability of LTI system, natural response and forced response, convolution, correlation. z-transform, Importance of z-transform, ROC, properties of z-transform, inverse z-transform, rational z-transform, concept of pole and zero, one-sided z-transform. Frequency analysis of continuous and discrete time signals, Fourier series, Fourier transform, energy and power density spectrum, Dirichlet conditions, properties of Fourier transform, frequency domain sampling, DFT, DFT as a linear transformation, properties of DFT, circular convolution, efficient computation of DFT, divide and conquer approach, radix-2 FFT, butterfly structure. Implementation of discrete time systems, FIR: direct form structure, lattice structure, transposed structure, IIR: direct form structure, transposed structure. Filter: features and applications of FIR and IIR filters, Fir filter design: window method and different types of windows, IIR filter design: pole-zero placement method, adaptive filter, applications of adaptive filters: noise cancellation, equalization, system identification, adaptive algorithms: LMS and RLS.

CSE-4264: Digital Image Processing [3.0 Credits, 45 Hours lectures]

Digital image file format: PPM, BMP, PCX, TIFF, JPEG, MPEG, GIF. Digital image representation: acquisition, storage and display systems sampling and quantization, uniform and nonuniform sampling. Image geometry: perspective transformation, synthetic camera approach, stereo imaging. Image transforms: FFT, DFT, sine/cosine transform. Image enhancement, spatial and frequency domains, smoothing and sharpening edge detection. Histogram; Graylevel binary images: shareholding, half-toning. Image restoration degradation model, constrained and uncosntrained restoration' inverse filtering, Wiener filtering' image compression: source encoding/decoding, channel encoding decoding. Mathematical Morphology: Dilation and Erosion, opening and closing. Image segmentation using mathematical morphology.

CSE-4265: Multimedia [3.0 Credits, 45 Hours lectures]

Introduction to Multimedia**:** Design Concepts, Preproduction and Presentation Graphics: Presentation Graphics Design, Preproduction, Typefaces and Graphics. Desktop Publishing, Production Planning and Design, User Interface Design, Hypermedia Authoring Concepts, Multimedia Sound, File Compression**,** Video Production, Digital Video, Animation, HTML & Web-Based Multimedia, Designing Web-based Multimedia, Producing Multimedia**,** Content & Legal Considerations for Multimedia, Content & Legal Considerations for Multimedia, Multimedia Distribution, Networking Multimedia.

CSE-4266: Pattern Recognition [3.0 Credits, 45 Hours lectures]

Introduction to pattern recognition: Classification Statistical Methods, Structural Methods and Hybrid method. Introduction to passen grammar and languages. Applications to character recognition medical imaging area. feature detection, classification, Review of probability and some linear algebra. Bayesian Decision making, linear discriminants, reparability, multi-class discrimination; quadratic classifiers, Fisher discriminant, sufficient statistics, coping with missing or noisy features, Bayesian estimation; non-parametric estimation; Non-parametric classification, density estimation, Parzen estimation,training methods, maximum likelihood, Bayesian parameter estimation, MAP. Linear discriminant functions.. Template-based recognition, eigenvector analysis, feature extraction, Eigen vector analysis. Clustering, unsupervised learning, vector quantization, K-means and E/M, neural nets. Sequence analysis, HMMs. k-nearest-neighbor classification, Mixture modeling, Optimization by ExpectationMaximization, Hidden Markov models, Viterbi algorithm, Baum-Welch algorithm, Linear dynamical systems, Kalman filtering and smoothing, Bayesian networks, independence diagrams, Decision trees, Multi-layer Perceptrons.

CSE-4267: Design and Analysis of VLSI Systems [3.0 Credits, 45 Hours lectures]

Introduction to MOS technology: POMS, NMOS and CMOS, transistors, CMOS Fabrication **Design Approaches:** Fabrication steps, steps stick diagrams, design rules and layout, contact cuts, double metal MOS process rules. MOS circuits, **Delay Analysis**: Inverter delay and its analysis, delay of different sequential and combinational circuit. **Sequential System:** Susperbuffer, Dynamic MOS circuits, Scaling of MOS circuits. Scaling factors and device parameters. **Subsystem design and layout**. **Switch logic**: pass transistors and transmission gates. Gate logic: The inverter, Two input nMOS, CMOS and BiCMOS gate design. Design of parity generator and multiplexers. Registers, Counters and memory realizations, One transistor and three transistors dynamic RAM cell design. **Hierarcihcal veiw of VLSI System Design**: Behavioral description High level Synthesis Scheduling, allocation and data path synthesis. **Logic synthesis**: multilevel minimization, PLA reduction regular structure circuits, Synthesis of FSM-ASM chart representation and realization, Layout synthesis, Placement and routing, Testing of VLSI, Testing of stuck-at fault, Testing of PLAs RAM. **Introduction to Reversible Logic:** Theory of reversibility, Reversible gates, reversible circuits, reversible logic synthesis. **FPGA:** Introductio to FPGA and FPGA programming using VHDL.

CSE-4268: Microcontroller and Embbeded System [3.0 Credits, 45 Hours lectures]

Introduction to the Embedded Systems, Embedded System Design Specifications, Embedded System Hardware and Hardware/Software Co-design, 8051/8052 family of Microcontrollers, C programming for Microcontrollers, I/O ports Programming, Timer/Counter hardware and Its Device Driver, Serial communication interface and Its Device Driver, Interrupts Programming, Embedded Software Development Cycle and the Integrated Development Environment, Debugging Techniques for Embedded Software and the Role of Cross Simulators, Real World Interfacing Case

Studies: LCD, Sensors, stepper motor, keyboard, PC, Design of Device Driver for Serial Devices, Concept of Finite State Machines and Examples - Stop Watch, Stepper Motor Control through PC, Remote Control of Systems using IR Remotes Used in Commercial TV Remote Control Modules, Simple Multi Drop Communication Networks With Examples, Simple Wireless Communication With Examples.

CSE-4269: Cyber Law and Computer Forensic [3.0 Credits, 45 Hours lectures]

Overview of Cybercrime: Amples of cybercrime, Unique Characteristics of Cybercrime, Cyber-attacks and attackers. Cybercrime Law. Computer Intrusions and Attacks: computer trespass, unauthorized access, relationship between acceptable use policies ("AUP"), terms of service ("TOS"), and criminal law. Hacking: Hacking for Grades, Hacking for harrassment ("swatting"), URL hacking, WiFi Mooching. Computer Viruses, Time Bombs, Trojans, Malicious Code, malware, Spam, Botnets, Logic Bomb, Rootkits. Online Fraud and Identity Theft: Intellectual Property Theft; Virtual Crime. Online Vice: Gambling; Pornography; Child Exploitation. International Aspects and Jurisdiction, Infrastructure and Information Security; Risk Management, Investigating Cybercrime: Interception: Search and Seizure, and Surveillance. Information Warfare: Cyberterrorism, and Hacktivism. Terrorism, Radicalization, and the War of Ideas. Trade Secret Theft and Economic Espionage. National Security. Computer Forensic: overview of the forensic relevance of encryption, the examination of digital evidence for clues, and the most effective way to present evidence and conclusions in a court of law.

CSE-4271: Natural Language Processing [3.0 Credits, 45 Hours lectures]

Words, Parts of Speech, Syntax, Grammars, Semantics, Language Modeling in General and the Noisy Channel Model**.,** Linguistics: Phonology and Morphology Word Classes and Lexicography. Mutual Information. The t-score. The Chi-square test. Hidden Markov Models (HMMs). The Trellis & the Viterbi Algorithms. HMM Tagging (Supervised, Unsupervised). Evaluation methodology (examples from tagging). Precision, Recall, Accuracy. Statistical Transformation Rule-Based Tagging. Maximum Entropy Tagging. Feature Based Tagging. Results on Tagging Various Natural Languages. Non-statistical Parsing Algorithms (An Overview). Simple top-down parser with backtracking. Probabilistic Parsing. Introduction. Statistical Machine Translation (MT).

CSE-4272: System Analysis and Design [3.0 Credits, 45 Hours lectures]

Introduction to general systems theory, Players in the Systems Game, Information Systems Building Blocks. Information Systems Development, Project Management. Systems Analysis, Requirements Discovery, Deliverables, Data Modeling and Analysis, Process Modeling, Feasibility Analysis and System Proposal, Systems Design, Applications Architecture and Modeling, Database Design, Output Design and Prototyping, Input Design and Prototyping, User Interface Design, Systems Construction and Implementation, Systems Operations and Support, Object-Oriented Analysis and Modeling, Object-Oriented Design and Modeling.

CSE-4273: Optical Fiber Communication [3.0 Credits, 45 Hours lectures]

History of optical communication, advantages and limitations of fiber communication. Theory of light: reflection, refraction, critical incident angle, total internal reflection. Electromagnetic waves, Maxwell's equation, damping waves, wavefront, propagation constant, phase velocity, group velocity. Basics of optical fiber: acceptance angle, numerical aperture, fiber structure, comparison with copper, meridional rays, skew rays, v number of a fiber, modes in a planar guide, Evanescent field, single mode fiber, multimode fibers. Fabrication of optical fibers: Vapor phase deposition techniques: OVD, MCVD, PCVD, VAD, coating. Optical sources: requirements , energy band diagram, LED: (principle of action, internal quantum efficiency, homostructure and heterostructure of LEDs), Laser: (principle of action, properties of stimulated radiation, positive feedback, population inversion, lasing effect, properties of laser beam, types of lasers: QW, Fabry-Perot, DFB, VCSEL), Superluminescent diodes (SLD), blocks of optical transmitter. Photo detectors: principle of action, responsivity, quantum efficiency, modes of operation, advantages of reverse biasing, sensitivity, efficiency of light-current conversion, p-i-n photodiodes: (features, types, advantages), avalanche photodiode: working principle, noise sources in photodiode, blocks of receiver. Losses in fiber: Material absorption loss, Linear scattering loss, Nonlinear scattering loss, Fiber bend loss, Coupling loss, Dispersion, Polarization loss. Fiber optic cables, optical connectors: (basic structure, preparation, types, characteristics), fiber splices: (splicing procedure, mechanical splice, fusion splice, PAS, PAT). Optical network: OTDM, WDM and DWDM: (lasers, transmitter requirements,

receiver requirements, add/drop problem, repeaters), Tunable lasers: (characteristics, external cavity, DBR, integrated cavity lasers). Optical amplifiers: advantages, types, SOA: (types: FPA and TWA, principle of operation, advantages, and disadvantages). EDFA: (principle of operation, characteristics, structure, advantages, noise, DBFA, EBFA). Optical switches, Wavelength converters, Couplers / splitters, WDM mux and demux, filters, Isolators, Circulators, Attenuators. Optical layer: sections, sublayers, services. Protection and restoration techniques.

CSE-4274: Human Computer Interaction [3.0 Credits, 45 Hours lectures]

Foundations of Human Computer Interaction: Humans and Machines, Interaction, Collaboration. Models in HCI: Cognitive Models, Socio-organizational Issues and Stakeholder Requirements. Importance of cognitive abilities. Design Process: Interaction Design Basics, HCI in Software Process, Design Rules, Universal Design, User Center Design. Design. Prototyping, Task Analysis, GOMS and other key HCI methods. Lifecycle Models. User Interfaces: Interfaces Basics, Interaction Techniques, System Control of Interfaces, Human Factors and Strategies in Designing Interfaces. Evaluation and User Support: Evaluation, Evaluation of Interfaces, User Support. Tasks Models and Dialogs: Analysing the Task, Dialog Notations and Design. Groupware, Ubiquitous Computing, Virtual and Augmented Reality. Social-Cultural Contexts of HCI.

CSE-4275: Graph Theory [3.0 Credits, 45 Hours lectures]

Fundamental concepts, varieties of graphs, path, cycles and components, degrees and distances, clique. Trees: Properties, spanning trees, forests, centroids, generation of trees and cycles, ent cycles and co-cycles. Connectivity: Vertex and edge connectivity, blocks, eccentricity, Menge's Theorem. Traversability: Eulerian graphs, kuratowski's theorem, embedding graphs on surfaces, genus, thickness and crossing number. Graph Coloring: Vertex coloring, edge coloring, chromatic number, five color theorem, four color conjecture, critical graph. Homomorphism Digraph: Different connectedness, oriented graphs-tournaments, network flows and related algorithms. Groups, polynomials and graph enumeration, matching and factorization, perfect graphs, Ramsey number and Ramsey theorem, forbidden graph theory, miscellaneous applications.

Optional Courses Lab

CSE-4281: Simulation and modeling Lab [1.5 Credits, 45 Hours]

(As per theory course CSE-4261)

CSE-4282: Cryptography and security Lab [1.5 Credits, 45 Hours]

(As per theory course CSE-4262)

CSE-4283: Digital Signal Processing Lab [1.5 Credits, 45 Hours]

(As per theory course CSE-4263)

CSE-4284: Digital Image Processing Lab [1.5 Credits, 45 Hours]

(As per theory course CSE-4264)

CSE-4285: Multimedia Lab [1.5 Credits, 45 Hours] (As per theory course CSE-4265)

CSE-4286: Pattern Recognition Lab [1.5 Credits, 45 Hours]

(As per theory course CSE-4266)

CSE-4287: Design and Testing of VLSI Systems Lab [1.5 Credits, 45 Hours]

(As per theory course CSE-4267)

CSE-4288: Micro-controller and Embedded System Lab [1.5 Credits, 45 Hours]
(As per theory course CSE-4268)

CSE-4289: CyberLaw and Computer Forensic Lab [1.5 Credits, 45 Hours]
(As per theory course CSE-4269)

CSE-4291: Natural Language Processing Lab [1.5 Credits, 45 Hours]
(As per theory course CSE-4271)

CSE-4292: System Analysis and Design Lab [1.5 Credits, 45 Hours]
(As per theory course CSE-4272)

CSE-4293: Optical Fiber Communication Lab [1.5 Credits, 45 Hours]
(As per theory course CSE-4273)

CSE-4294: Human Computer Interaction Lab [1.5 Credits, 45 Hours]
(As per theory course CSE-4274)

CSE-4295: Graph Theory Lab [1.5 Credits, 45 Hours]
(As per theory course CSE-4275)