Syllabus of Bachelor of Science in Computer Science and Engineering (CSE)

United International **University**

House # 80, Road # 8/A, Satmasjid Road Dhanmondi, Dhaka-1209, Bangladesh

Rapid development in the fields of Computer Science and Engineering (CSE) over the last decade has made Computer Science and Engineering an emerging field of specialization. The university has been successfully running its B.Sc. in CSE program (UGC approval BIMAKA/SHA/414(1)/02/2974 on 25/06/2005) since its inception as one of the private universities in Bangladesh. The university needs to revise the syllabus of its CSE program in order to meet the current needs of home and abroad.

Bachelor of Science in Computer Science and Engineering primarily involves the study of a number of core courses which every CSE graduate should know and a significant number of courses from specialized areas. Core courses build the foundation and specialized courses prepare the students for the specific areas of Computer Science and Engineering. To understand the underpinning theory of the courses of Computer Science and Engineering, a number of courses on Mathematics and Basic Science have been felt mandatory to include in the syllabus. In addition some social science, management, accounting, economics and communication-skills development related courses have been incorporated to make the syllabus a balanced and reasonably complete one. The objective of the undergraduate program in Computer Science and Engineering is to develop skilled and competent graduates to meet the current and future needs at home and abroad.

The letter prefix in any course number indicates the discipline/subject offering the course viz. ACT for Accounting, PHY for Physics, MATH for Mathematics and CSE for Computer Science and Engineering..

Trimester 1

Sl. No.	Course Code	Course Title	Credit Hr.
1.	MATH 003	Elementary Calculus	3.00
2.	ENG 002	Pre English	
3.	ENG 101	English I	3.00
4.	CSI 121	Structured Programming Language	3.00
5.	CSI 122	Structured Programming Language Lab	1.00
		Subtotal	10.00

*Non-credit mandatory course with 3 contact hours.

Trimester 2

Sl. No.	Course Code	Course Title	Credit Hr.
1.	MATH 151	Differential and Integral Calculas	3.00
2.	CSI 219	Discrete Mathematics	3.00

3.	ENG 103	English II	3.00
4.	CSI 124	Advanced Programming Lab	1.00
		Subtotal	10.00

Trimester 3

Sl. No.	Course Code	Course Title	Credit Hr.
1.	CSI 217	Data Structure	3.00
2.	CSI 218	Data Structure Lab	1.00
3.	MATH 183	Linear Algebra, Ordinary and Partial Differential Equations	3.00
4.	CSE 113	Electrical Circuits	3.00
5.	PHY 105	Physics	3.00
6.	PHY 106	Physics Lab	1.00
		Subtotal	14.00

Trimester 4

Sl. No.	Course Code	Course Title	Credit Hr.
1.	CSI 227	Algorithms	3.00
2.	CSI 228	Algorithms Lab	1.00
3.	CSE 225	Digital Logic Design	3.00
4.	CSE 226	Digital Logic Design Lab	1.00
5.	MATH 187	Fourier and Laplace Trans. & Complex Variables	3.00
		Subtotal	11.00

Trimester 5

Sl. No.	Course Code	Course Title	Credit Hr.

1.	MATH 201	Coordinate Geometry and Vector Analysis	3.00
2.	CSI 211	Object Oriented Programming	3.00
3.	CSI 212	Object Oriented Programming Lab	1.00
4.	CSE 123	Electronics	3.00
5.	CSE 124	Electronics Lab	1.00
6.	____	Humanities / Business	3.00
		Subtotal	14.00

Trimester 6

Sl. No.	Course Code	Course Title	Credit Hr.
1.	CSE 313	Computer Architecture	3.00
2.	CSI 233	Theory of Computing	3.00
3.	STAT 205	Probability and Statistics	3.00
4.	CSI 229	Numerical Methods	3.00
5.	CSE 236	Assembly Programming Lab	1.00
		Subtotal	13.00

Trimester 7

Sl. No.	Course Code	Course Title	Credit Hr.
1.	____	Humanities / Business	3.00
2.	CSI 309	Operating System Concepts	3.00
3.	CSI 310	Operating System Concepts Lab	1.00
4.	CSE 315	Data Communication	3.00
5.	CSI 411	Compiler	3.00
6.	CSI 412	Compiler Lab	1.00
		Subtotal	14.00

Trimester 8

Sl. No.	Course Code	Course Title	Credit Hr.
1.	CSI 221	Database Management Systems	3.00
2.	CSI 222	Database Management Systems Lab	1.00
1.	CSE 323	Computer Networks	3.00
2.	CSE 324	Computer Networks Lab	1.00
3.	CSE 425	Microprocessor, Microcontroller and Interfacing	3.00
4.	CSE 426	Microprocessor, Microcontroller and Interfacing lab	1.00
		Subtotal	12.00

Trimester 9

Sl. No.	Course Code	Course Title	Credit Hr.
3.	CSI 311	System Analysis and Design	3.00
4.	CSI 312	System Analysis and Design Lab	1.00
1.	CSI 341	Artificial Intelligence	3.00
2.	CSI 342	Artificial Intelligence Lab	1.00
5.	_____	Humanities / Business	3.00
		Subtotal	11.00

Trimester 10

Sl. No.	Course Code	Course Title	Credit Hr.
1.	CSI 321	Software Engineering	3.00
2.	CSI 322	Software Engineering Lab	1.00
3.	CSI ___	Option I Theory	3.00
4.	CSI ___	Option I Lab	1.00
5.	CSI ___	Option II	3.00
6.	CSE 400	Thesis / Project	2.00
		Subtotal	13.00

Trimester 11

Sl. No.	Course Code	Course Title	Credit Hr.
1.	CSE 429	Digital System Design	3.00
2.	CSE 430	Digital System Design Lab	1.00
3.	CSI ___	Option I Theory	1.00
4.	CSI ___	Option I Lab	3.00
5.	CSI ___	Option II	3.00
		Subtotal	11.00

Trimester 12

Sl. No.	Course Code	Course Title	Credit Hr.
1.	CSE 400	Project / Thesis	2.00
2.	CSE ___	Option II	3.00
		Subtotal	5.00

List of Optional Courses (CSE ….)

Option I

Sl. No.	Course Code	Course Title	Credit Hr.
1.	CSI 415	Pattern Recognition	3.00
2.	CSI 416	Pattern Recognition Lab	1.00
3.	CSI 421	Computer Graphics	3.00
4.	CSI 422	Computer Graphics Lab	1.00
5.	CSI 423	Simulation & Modeling	3.00
6.	CSI 424	Simulation & Modeling Lab	1.00
7.	CSI 447	Multimedia Systems Design	3.00
8.	CSI 448	Multimedia Systems Design Lab	1.00
9.	CSE 427	VLSI Design	3.00
10.	CSE 428	VLSI Design Lab	1.00

Option II

Sl. No.	Course Code	Course Title	Credit Hr.
1.	CSE 453	Optical Fiber Communication	3.00
2.	CSE 457	Mobile Cellular Communication	3.00
3.	CSE 461	Wireless Communication	3.00
4.	CSE 463	E-Commerce	3.00
5.	CSE465	Web Programming	3.00
6.	CSE 467	Advanced DBMS	3.00
7.	CSE 469	Project Management	3.00
8.	CSE 471	Advanced Object Oriented Programming	3.00

Sl. No.	Course Code	Course Title	Credit Hr.
9.	CSE 473	Advanced Network Services & Management	3.00
10.	CSE 475	Mobile Computing	3.00
11.	**CSE 477**	**Network Security**	**3.00**
12.	**CSE 479**	**Embedded Systems**	**3.00**
13.	**CSE 481**	**Mobile Application Development**	**3.00**
14.	**CSE 483**	**Digital Image Processing**	**3.00**
15.	**CSE 485**	**Game Design and Development**	**3.00**
16.	**CSE 487**	**Cloud Computing**	**3.00**

Optional courses are divided into two categories, option I and Option II. A student has to complete 2 sets of from Option I and 3 courses from Option II.

Credit hours distribution in twelve trimesters

Trimester	Theory Credit	Lab. Credit	Total Credit
Trimester 1	9.00	1.00	10.00
Trimester 2	9.00	1.00	10.00
Trimester 3	12.00	2.00	14.00
Trimester 4	9.00	2.00	11.00
Trimester 5	12.00	2.00	14.00
Trimester 6	12.00	1.00	13.00
Trimester 7	12.00	2.00	14.00
Trimester 8	9.00	3.00	12.00
Trimester 9	9.00	2.00	11.00
Trimester 10	11.00	2.00	13.00
Trimester 11	9.00	2.00	11.00
Trimester 12	5.00	00	5.00
Total	118.00	20.00	138.00

DEGREE REQUIREMENTS

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

(a) Completion of 138.0 credit hours

(b) Completion of the project with at least a 'C' grade

(c) Passing of all courses individually and maintaining a minimum CGPA of 2.00**.**

Details of the Course Contents

Phy 105

Heat & thermodynamics: Principle of temperature measurements: Platinum resistance thermometer, Thermo-electric thermometer, Pyrometer; Kinetic theory of gases: Maxwell's distribution of molecular speeds, Mean free path, Equipartition of energy, Brownian motion, van der Waal's equation of state, Review of the First law of thermodynamics and its application, Reversible & irreversible processes, Second law of thermodynamics, Carnot; Efficiency of heat

engines, Carnot theorem, Entropy and Disorder, Thermodynamic Functions, Maxwell relations, Clausius-Clapeyron equation, Gibbs phase rule, Third law of thermodynamics.

***Physical Optics**:* Theories of light: Interference of light, Young's double slit experiment, Displacements of fringes & its uses. Fresnel Bi-prism, Interference at wedge shaped films, Newton's rings, Interferometers; Diffraction of light: Fresnel and Fraunhoffer diffraction. Diffraction by single slit. Diffraction from a circular aperture, Resolving power of optical instruments, Diffraction at double slit & N-slits-diffraction grating; Polarization: Production & analysis of polarized light, Brewster's law, Malus law, Polarization by double refraction. Retardation plates. Nicol prism. Optical activity. Polarimeters, Polaroid.

Modern Physics: Michelson-Morley's experiment. Galilean transformation, Special theory of relativity & its consequences; Quantum theory of Radiation: Photo-electric effect, Compton effect, wave particle duality. Interpretation of Bohr's postulates, Radioactive disintegration, Properties of nucleus, Nuclear reactions, Fission. Fusion, Chain reaction, Nuclear reactor.

Phy 106 Physics Laboratory

Experiments based on Phy 105

SOC 101 Society, Technology and Engineering Ethics

Historical Background for the emergence of Sociology as moral lessons for society. French Revolution, Industrial Revolution. Commonsense and Knowledge. Basics of Sociology. Culture, Elements of Culture, Cultural Lag, What is Ethics? Socialization, Agents of Socialization, Basic Institutions in society. Basic Association and Institutions in society, Type of Societies. Some recent social issues around us (poverty, rehabilitation, Gender discrimination, environment) Some social issues around us (Social Change, Urbanization, development, deviance and control). What is Engineering Ethics about? Moral reasoning. Engineering as Social Experimentation. The Engineer's Concern for safety. Professional Responsibility. Employer Authority. Rights of Engineers. Global Issues. Career Choice and Professional Outlook. Ethical Problems are like Design Problems.

ACT 111 Financial and Managerial Accounting

Financial Accounting: Objectives and importance of accounting; Accounting as an information system; Computerized system and applications in accounting. Recording system: double entry mechanism; accounts and their classification; Accounting equation; Accounting cycle: journal, ledger, trial balance; Preparation of financial statements considering adjusting and closing entries; Accounting concepts (principles) and conventions.

Financial statement analysis and interpretation: ratio analysis.

Cost and Management Accounting: Cost concepts and classification; Overhead cost: meaning and classification; Distribution of overhead cost; Overhead recovery method/rate; Job order

costing: preparation of job cost sheet and quotation price; Inventory valuation: absorption costing and marginal/variable costing techniques; Cost-Volume-Profit analysis: meaning breakeven analysis, contribution margin approach, sensitivity analysis.

Short-term investment decisions: relevant and differential cost analysis. Long-term investment decisions: capital budgeting, various techniques of evaluation of capital investments.

ECO 213 Economics

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

IPE 401 Industrial Management

Introduction, evolution, management function, organization and environment.

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

Personnel Management: Scope; Importance; Need hierarchy; Motivation; Job redesign; Leadership; Participative management; Training; Performance appraisal; Wages and incentives; Informal groups; Organizational change and conflict.

Cost and Financial Management; Elements of costs of products depreciation; Break-even analysis; Investment analysis; Benefit cost analysis.

Management Accounting: Cost planning and control; Budget and budgetary control; Development planning process.

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

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

PSY 101 Psychology

The objective of this course is to provide knowledge about the basic concepts and principles of psychology pertaining to real-life problems. The course will familiarize students with the fundamental processes that occur within organism-biological basis of behavior, perception, motivation, emotion, learning, memory and forgetting and also to the social perspective-social perception and social forces that act upon the individual.

MGT 101 Principles of Management

Meaning and Importance of Management; Evolution of Management thought; Decision making process; environmental impact on management; Corporate social responsibility; Basic functions of management - Planning; setting objectives; Implementing plans; Organizing; Organization design; Human resource management: Direction; Motivation; Leadership; Managing work groups; Controlling: Control principles; Process; and problems; Managers and Changing Environment.

SOC 103 Sociology

The objective of this course is to introduce students to key societal concepts, primary social institutions, social structure and stratification, religion and so on. They will also be familiar with the methods and different techniques of social research.

ENG 101 English I

The course aims at developing proficiency in speaking, listening, reading, and writing of English. It is generalized as a remedial course for students whose English need considerable repair and as a foundation course for ENG 102. The contents include parts of speech, count and uncountable nouns and articles, agreement between subject and verb, adverbs of frequency, tense and the sequence of tenses, active and passive voices, types of sentences, prepositions: time, place, action, directions, questions forms, multi-word verbs, capitalization.

ENG 103 English II

A course to provide a solid foundation on perfecting skills in English reading, writing, listening comprehension and speaking. The course emphasizes the practice of pronunciation, speed-reading, and effective writing and listening. The course contents include the grammar parts of revision of tenses, use of idioms, prepositions, modals, conditional sentence, use of linking words, use of suffixes and prefixes, synonyms and antonyms, words with multi names, reading parts include the skills in skimming, scanning, selecting information, writing parts include

planning, outlining, organizing ideas, topic sentences, paragraph writing, essay writing, job applications, writing reports, writing research report.

Math 003 Elementary Calculus

Number System, Functions; New functions from old, Families of functions, Inverse function, Exponential and Logarithmic function, Limit and Continuity, Tangent line and rate of change. The derivative function, Chain Rule, Integration: An overview of the area problem, the Indefinite Integral, Integration by substitution, The definition of area as a limit, The definite integral, Fundamental theorem of calculus, Area between two curves, Volumes by slicing, disk and Washers , Area of a surface of revolution, length of a plane curve, Cylindrical Shells.

Math 151 Differential and Integral Calculus

Differential Calculus: Limits, Continuity and differentiability. Successive differentiation of various types of functions, Leibnitz's theorem, Roller's theorem, Mean value theorem. Taylor's and Maclaurin's theorems in finite and infinite forms. Lagrange's form of remainders. Cauchy's form of remainders. Expansion of functions by differentiation and integration. Evaluation of indeterminate forms by L'Hospitals rule. Partial differentiation. Euler's theorem. Tangent and Normal. Subtangent and subnormal in cartesian and polar co-ordinates. Determination of Maximum and minimum values of functions and points of inflection with applications. Curvature: radius, circle, centre and chord of curvature, asymptotes and curved tracing.

Integral Calculus : Integration by the method of substitution. Standard integrals. Integration by successive reduction. Definite integrals, its properties and use in summing series. Walli's formulate. Improper integrals. Beta function and Gamma function. Area under a plane curve and area of a region enclosed by two curves in cartesian and polar co-ordinate. Volumes of solids of revolution. Volume of hollow solids of revolution by shell method Area of surface of revolution. Jacobians. Multiple integrals with applications.

Math 183 Linear Algebra, Ordinary & Partial Differential Equations

Ordinary Differential Equations: Degree and order of ordinary differential equations. Formation of differential equations, Solutions of first order differential equations by various methods. Solutions of general linear equations of second and higher orders with constant coefficients.

Solution of homogeneous linear equations. Solution of differential equation of the higher order when the dependent or independent variable is absent. Solution of differential equation by the method based on the factorization of the operators. Frobenius method.

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

Matrices: Definition, equality, addition, subtraction multiplication, transposition, inversion, rank. Equivalence, solution of equations by matrix method. Vector space, Eigen values and Eigen vectors. Bassel's and Legendre's differential equations.

Math 187 Fourier and Laplace Transformations and Complex Variables

Laplace Transforms: Definition. Laplace transforms of some elementary functions. Sufficient conditions for existence of Laplace transforms. Inverse Laplace transforms. Laplace transforms of derivatives. The unit step function. Periodic function. Some special theorems on Laplace transforms. Partial fraction. Solution of differential equations by Laplace transforms. Evaluation of improper integrals.

Fourier Analysis: Real and complex forms of Fourier series. Finite transform. Fourier integral. Fourier transforms and their uses in solving boundary value problems.

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

Math 201 Coordinate Geometry and Vector Analysis

Two-dimensional co-ordinate Geometry: Change of axes-transformation of co-ordinates, simplification of equations of curves.

Three-dimensional co-ordinate Geometry: System of co-ordinates, distance between two points, section formula, projection, direction cosines, equations of planes and lines.

Vector Analysis: Definition of vectors. Equality, addition and multiplication of vectors. Linear dependence and independence of vectors. Differentiation and integration of vectors together with elementary applications. Definitions of line, surface and volume integrals. Gradient of a scalar function, divergence and curl of a vector function. Physical significance of gradient, divergence and curls. Various formulae. Integral forms of gradient, divergence and curl. Divergence theorem. Stoke's theorem, Green's theorem and Gauss's theorem.

STAT 205 Probability and Statistics

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

CSI 121 Structured Programming Language

Overview, Structure of C program, Data Types, I/O Functions, Identifiers, Expressions, Statement and Symbolic Constants, Arithmetic operators, Relational Operators and Logical Operators, Bit-wise Operators, Precedence and Associativity, Control statements, Storage class, Functions, Command Line Parameters and Library Functions, Arrays, Strings, Structure, Union and Bit-fields, Pointer, Memory Allocation and Release, Pointer and Multi-Dimensional Arrays, File Handling, Video Adapter, Modes and Graphics Initialization, Graphics Functions.

CSI 122 Structured Programming Language Laboratory

Laboratory work based on **CSI 121**

CSI 124 Advanced Programming Laboratory

Advanced topics on structure, pointer, and file operations in C. A Project work will be a part of this course. Introduction to Object Oriented Programming using C++.

CSI 211 Object Oriented Programming (Pre-requisite CSI 121)

Object oriented fundamentals, Java Application, Java applets, Methods, Arrays, String & characters, Graphics & java2D, Basic graphical user interface components, Multithreading, Multimedia, Files & streams, JDBC, Servlets, RMI, Networking, Java beans.

CSI 212 Object Oriented Programming Laboratory

Laboratory work based on **CSI 211**

CSI 217 Data Structure (Pre-requisite CSI 121)

Concepts and examples, elementary data objects, elementary data structures, arrays, lists, stacks, queues, graphs, trees, Memory management, Sorting and searching, hash techniques.

CSI 218 Data Structure Laboratory

Laboratory work based on **CSI 217**

CSI 219 Discrete Mathematics

Set theory, Elementary number theory, Graph theory, Paths and trees, Generating functions, Algebraic structures, Semi graph, Permutation groups, Binary relation, Mathematical logic, Propositional calculus and predicate calculus.

CSI 221 Database Management Systems

Concepts and methods in database system, File organization and retrieval, Data manipulation, Query formulation and language, Database models, Data description languages, database integrity and security, Data dictionary/directory systems, database administration, Database design, Survey of some existing database management systems, Some applications using commercial languages.

CSI 222 Database Management Systems Laboratory

Laboratory work based on **CSI 221**

CSI 227 Algorithms (Pre-requisite CSI 217 and CSI 219)

Techniques for analysis of algorithms, Methods for the design of efficient algorithms: divide and conquer, greedy method, dynamic programming, back tracking, branch and bound, Basic search and traversal techniques, graph algorithms, Algebraic simplification and transformations, lower bound theory, NP-hard and NP-complete problems.

CSI 228 Algorithms Laboratory

Laboratory work based on **CSI 227**

CSI 229 Numerical Methods

Computational methods for solving problems in linear algebra, linear programming, nonlinear equations, approximations, iterations, methods of least squares, interpolation, integration and ordinary differential equations.

CSI 233 Theory of Computing

Finite Automata: Deterministic finite automata, Non-deterministic finite automata, equivalence and conversion of deterministic and non-deterministic finite automata, pushdown automata. Context free language, context frees grammar. Turing machines: basic machines, configuration, computing with turning machine, combining turning machines.

CSI 309 Operating System Concepts

Principles of operating systems, design objectives, sequential processes, concurrent processes, concurrency, functional mutual exclusion, processor cooperation and deadlocks, processor management, Control and scheduling of large information processing systems, Resource allocation, dispatching, processor access methods, job control languages, Memory management, memory addressing, paging and store multiplexing, Multiprocessing and time sharing, batch processing, Scheduling algorithms, file systems, protection and security, design and implementation methodology, performance evaluation and case studies.

CSI 310 Operating System Concepts Laboratory

Laboratory work based on **CSI 309**

CSI 311 System Analysis and Design

Information, general concepts of formal information systems, analysis of information requirements for modern organizations, modern data processing technology and its application, information systems structures, designing information outputs, classifying and coding data, physical storage media considerations, logical data organization, systems analysis, general systems design, detail system design, Project management and documentation, Group development of an information system project: includes all phases of software life cycles from requirement analysis to the completion of a fully implemented system.

CSI 312 System Analysis and Design Laboratory

Laboratory work based on **CSI 311**

CSI 321 Software Engineering ((Pre-requisite CSI 311)

Concepts of software engineering: requirements definition, modularity, structured design, data specifications, functional specifications, verification, documentation, software maintenance, Software support tools, Software project organization, quality assurance, management and communication skills.

CSI 322 Software Engineering Laboratory

Laboratory work based on **CSI 321**

CSI 341 Artificial Intelligence (Pre-requisite CSI 227)

Survey and concepts in Artificial Intelligence, Problem solving agents, Uninformed and Informed search techniques, Game playing, Knowledge representation, Inference in Propositional and First Order logic, Theorem Proving, Decision tree learning, Neural Network, Bayesian learning, planning.

CSI 342 Artificial Intelligence Laboratory

Laboratory work based on **CSI 341**

CSI 411 Compiler (Pre-requisite CSI 233)

The grammar of programming languages, Lexical analyzers, Parsers, Code emitters and interpretation, Code optimization, Run time support, Error Management, Translator writing system, A small project.

CSI 412 Compiler Laboratory

Laboratory work based on **CSI 411**

CSI 415 Pattern Recognition (Pre-requisite CSI 341)

Introduction to pattern recognition: Sensing, Segmentation, feature Extraction, Calssification, post processing, Design Cycle, learning, statistical methods, Bayes theorem, structural methods and hybrid method. Linear Classifier, Perceptron Algorithm, Least Sqaure Method, Non-Linear Classifier, Two Layer Perceptron, BackPropagation Algorithm, Template Matching – Bellman's Principle, Edit Distance, Correlation Based Measurement, Context Dependent Classification-Bayes Classifier, Markov Chain, Viterbi Algorithm, Non-Parmetric Decision Making, Clustering.

CSI 416 Pattern Recognition Laboratory (Pre-requisite CSI 342)

Laboratory work based on **CSE 415**

CSI 421 Computer Graphics (Pre-requisite MATH 201 & CSI 227)

Introduction to Graphical data processing, Fundamentals of interactive graphics programming, Architecture of display devices and connectivity to a computer, Implementation of graphics concepts of two-dimensional and three-dimensional viewing, clipping and transformations, Hidden line algorithms, Raster graphics concepts: Architecture, algorithms and other image synthesis methods, Design of interactive graphic conversations.

CSI 422 Computer Graphics Laboratory (**Pre-requisite CSI 228)**

Laboratory work based on **CSI 421**

CSI 423 Simulation & Modeling (Pre-requisite STAT 205)

Simulation methods, model building, random number generator, statistical analysis of results, validation and verification techniques, Digital simulation of continuous system, Simulation and analytical methods for analysis of computer systems and practical problems in business and practice, introduction to simulation packages.

CSI 424 Simulation & Modeling Laboratory (Pre-requisite STAT 205 & CSI 122)

Laboratory work based on **CSI 423**

CSI 447 Multimedia Systems Design (Pre-requisite CSE 323)

Overview to multimedia systems, multimedia storage. Data compression techniques for audio and video. Synchronization. Multimedia networking and protocols, QOS principles. Video streams on ATM. Mobile multimedia computations. Operating system support for multimedia. Hypermedia system. Standard for multimedia. Multimedia database and multimedia applications

CSI 448 Multimedia Systems Design Laboratory (Pre-requisite CSE 324)
Laboratory work based on **CSI 447**

CSE 427 VLSI Design (Prerequisite CSE 225)

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

CSE 428 VLSI Design Laboratory (Pre-requisite CSE 226)
This course consists of two parts. In the first part, students will perform experiments to verify practically the theories and concepts learned in CSE 427. In the second part, students will design simple systems using the principles learned in CSE 427.

CSE 113 Electrical Circuits

Fundamental electrical concepts and measuring units, D.C. voltages, current, resistance and power, laws of electrical circuits and methods of network analysis, principles of D.C. measuring apparatus, laws of magnetic fields and methods of solving simple magnetic circuits. Alternating current, Instantaneous and RMS current, voltage and power, average power combinations of R, L & C circuits, Phasor, representation of sinusoidal quantities.

CSE 123 Electronics (Pre-requisite CSE 113)
Semiconductors, junction diode characteristics, Bipolar transistors: characteristics, small signal low frequency h-parameter model, hybrid-pi model, amplifiers, voltage and current amplifiers, oscillators, differentials amplifiers, operational amplifiers, linear application of operational amplifiers, gain input and output impedance.

CSE 124 Electronics Laboratory

Laboratory work based on **CSE 123**

CSE 225 Digital Logic Design

Digital logic, Boolean algebra, De-Morgan's law, logic gates and their truth tables, canonical forms, Combinational logic circuits, minimization techniques, Arithmetic and data handling logic circuits, decoders and encoders, Multiplexers and demultiplexers, Combinational Circuit

design, Flip-flops, race around problems, Counters and their applications, PLA design, Synchronous and asynchronous logic design: state diagram, Mealy and Moore machines, State minimizations and assignments, Pulse mode logic, Fundamental mode design.
Diode logic gates, transistor switches, transistor transistor gates, MOS gates, Logic families: TTL, ECL, IIL and CMOS logic with operation details, Propagation delay, product and noise immunity, Open collector and High impedance gates, memory systems, A/D and D/A converters with applications

CSE 226 Digital Logic Design Laboratory

Laboratory work based on **CSE 225**

CSE 236 Assembly Programming Laboratory (Pre-requisite CSE 113)

Laboratory work based on microprocessor assembly language

CSE 313 Computer Architecture (Pre-requisite CSE 225 & CSE 226)

Information representation and transfer, instruction and data access methods, the control unit: hardwired and microprogrammed, memory organization, I/O systems, channels, interrupts, DMA, Von Neumann SISD organization, RISC and CISC machines.
Pipelined machines, interleaved memory system, caches, Hardware and architectural issues of parallel machines, Array processors, associative processors, multiprocessors, systolic processors, data flow computers and interconnection networks, High level language concept of computer architecture.

CSE 315 Data Communication (Pre-requisite MATH 187)

Introduction to modulation techniques: Pulse modulation, pulse amplitude modulation, pulse width modulation and pulse position modulation, Pulse code modulation, quantization, Delta modulation, TDM, FDM, OOK, FSK, PSK, QPSK, Representation of noise, threshold effects in PCM and FM, Probability of error for pulse systems, concept of channel coding and capacity, Asynchronous and synchronous communications, Hardware interfaces, multiplexers, concentrators and buffers, Communication medium, Fiber optics.

CSE 323 Computer Networks (Pre-requisite CSE 315)

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

CSE 324 Computer Networks Laboratory

Laboratory work based on **CSE 323**

CSE 429 Digital System Design (Pre-requisite CSE 425 & CSE 426)

Designing I/O system; I/O devices; Designing Microprocessor based system with interfacing chips; Programmable peripheral interface (interface to A/D and D/A converter); Keyboard/display interface; Programmable timer; Programmable interrupt controller, DMA controller; Design using MSI and LSI components; Design of memory subsystem using SRAM and DRAM; Design of various components of a computer: ALU, memory and control unit: hardwired and micro programmed; Microprocessor based designs; Computer BUS standards; Design special purpose controllers.

CSE 430 Digital System Design Laboratory (Pre-requisite CSE 426)

Students will design simple systems using the principles learned in CSE 429.

CSE 425 Microprocessor, Microcontroller and Interfacing (Pre-requisite CSE 236)

Introduction to 8-bit, 16-bit, and 32-bit microprocessors: architecture, addressing modes, instruction set, interrupts, multi-tasking and virtual memory; Memory interface; Bus interface; Arithmetic co-processor; interfacing: programmable peripheral interface, programmable timer, serial communication interface, programmable interrupt controller, direct memory access, keyboard and display interface, Integrating microprocessor with interfacing chips; Microcontroller: Introduction to micro-controllers(i.e. 8051), How to Program an 8-bit Microcontroller using C and assembly language, Introduction to Embedded System, Embedded Systems programming.

CSE 426 Microprocessor, Microcontroller and Interfacing Laboratory (Pre-requisite CSE 236)

Students will design simple systems using the principles learned in CSE 425.

CSE 453 Optical Fiber Communication (Pre-requisite CSE 323)

Introduction. Light propagation through optical fiber: Ray optics theory and mode theory. Optical fiber: Types and characteristics, transmission characteristics, fiber joints and fiber couplers. Light sources: Light emitting diodes and laser diodes. Detectors: PIN photo-detector and avalanche photo-detectors. Receiver analysis: Direct detection and coherent detection, noise and limitations. Transmission limitations: Chromatic dispersion, nonlinear refraction, four wave mixing and laser phase noises. Optical amplifier: Laser and fiber amplifiers, applications and

limitations. Multi-channel optical system: Frequency division multiplexing, wavelength division multiplexing and co-channel interference.

CSE 457 Mobile Cellular Communication (Pre-requisite CSE 323)

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

CSE 461 Wireless Communication (Pre-requisite CSE 323)

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

CSE 463 E-Commerce (Pre-requisite CSE 323)

History, business models; Ecommerce channels: Portals, auctions, communities, marketplace; Managing the marketplace: Demographics and advertising; Customer relationship management, web services for B2B and B2C ecommerce, electronic payment systems; Network security, cryptography, digital certificates; Markup for ecommerce: XML, M-commerce, wireless and U-commerce, digital money and electronic banking; Ethical, legal, and regulatory environment: Intellectual property, copyright, trademark, patents.

CSE 465 Web Programming (Pre-requisite CSI 211 & CSI 212)

Web architecture and HTTP: History and architecture of the World Wide Web, overview of the Hyper Text Transfer Protocol, other related protocols; Hyper Text Markup Language: The concept of markup, overview of HTML (table, form, frame, window, link etc.); Client side scripting: Variables, data types, control structure, functions, Document Object Model (DOM), event handlers, properties, methods, cookies; Server side scripting: Concepts, variables, data

types, control structure, functions, objects; Database: Content generation, data exchange; Regular expressions, mails, cookies, sessions.

CSE 467 Advanced Database Management Systems (Pre-requisite CSI 221)

Database system architecture; managing primary and secondary storage; query processing; metadata and catalog management; language processing; query optimization and plan generation; concurrency; failures and recovery; extensibility; client-server interactions. Object-oriented database systems, XML, database and the web, data management in distributed mobile computing environment, data broadcasting, text database, digital library design and implementation, multimedia database: Basic concept, design and optimization of access strategies; parallel database, spatial database, temporal database.

CSE 469 Project Management (Pre-requisite CSI 321)

Software project management; software development team configuration and maintenance; software project documentation; communication in a software project (reporting and presentations); project management tools; advanced life cycle models; measurement, metrics and control; testing; systems integration; maintenance; systems development automation.

CSE 471 Advanced Object Oriented Programming (Pre-requisite CSI 211)

Introduction to Object Oriented Design, Modeling Concept: Modeling as a Design Technique, Object Modeling, Dynamic Modeling and Functional Modeling; Design Methodology: Methodology Preview, Analysis, system Design, Object Design and Comparison of Methodologies.

Design Implementation: Design Implementation, Programming Style, Object Diagram Compiler; Future of Object-Oriented Technology. In addition, the course covers areas of object storage and retrieval, distributed systems, business rules and objects and introduces architecture for supportable systems. Emphasizing productivity and quality, the course concludes with pragmatic guidelines on how to incorporate testing and quality assurance into the development process of object-oriented systems.

CSE 473 Advanced Network Services and Management (Pre-requisite CSE 323)

Application specific protocols: Domain Name Services, Electronics mail, World Wide Web and Web caching, Network Management (SNMP), Error Reporting Mechanism (ICMP), Socket Interfaces, File Transfer and Remote File Access, Multimedia application: RTP, Session Control; Network security: Cryptographic algorithm, security mechanism, authentication protocol, firewall.

CSE 475 Mobile Computing (Pre-requisite CSE 323)

Introduction to mobile computing; Data link layer considerations: Channel allocation, Wireless LANs, Bluetooth; Network layer considerations: Mobile IPv4 and Mobile IPv6, Micro-mobility solutions to the host mobility problem, Routing in mobile ad hoc networks; Transport layer considerations: TCP in wired/wireless environments; Application layer considerations: Adaptation, Disconnected operation, Mobile agents, Security; Wireless sensor networks.

Course Code: CSE 477

Course Title: Network Security

Credit hours: 3.00

Prerequisite: CSE 323, CSE 324

Contents: Computer Security Concepts: OSI security architecture, security attacks, security services, security mechanisms, network security model.

Classical Encryption Techniques: symmetric cipher model, cryptanalysis, substitution techniques (Ceaser, Monoalphabetic, Playfair, Hill cipher), transposition techniques, rotor machines, steganography. Block

Ciphers and the Data Encryption Standard (DES): block cipher principles, Data Encryption Standard (DES), strength of DES, differential and linear cryptanalysis.

Public-Key Cryptography and RSA: principles of public-key cryptosystems, RSA algorithm.

Diffie-Hellman Key Exchange: Discrete logarithm, key exchange and generation algorithm, attacks on Diffie-Hellman protocol.

Cryptographic Hash Functions: applications of cryptographic hash functions, requirements and security, hash functions based on Cipher Block Chaining (CBC), Secure Hash Algorithm (SHA).

Digital Signatures: essential elements, limitations of symmetric key, Digital Signature Standard (DSS). Distribution of public keys and X.509.

Network Security Protocols: Authentication, key exchange and key distribution protocols.

Network Security Standards: IP security (IPsec), Secure Sockets Layer (SSL), Transport Layer Security (TLS), Hypertext Transfer Protocol Secure (HTTPS).

Security analysis: Use of formal tools, e.g., Automated Validation of Internet Security Protocols and Applications (AVISPA).

Course Code: CSE 479

Course Title: Embedded Systems

Credit hours: 3.00

Prerequisite: CSE 425, CSE 426

Contents: Introduction to embedded systems: Background, history, classifications, programming languages for embedded systems.

Embedded System Processors: Combinational logic and transistors, RT-level combinational and sequential components, customized single purpose processor design.

Microcontroller Organization: Structure of microcontrollers, CPU, memory and I/O structure, various microcontrollers, PIC, Rabbit and ARM.

CPU and Bus Systems: I/O and memory mapping, addressing modes, interrupts and traps, bus protocols, DMA, system bus configurations, the AMBA and AHB buses, memory devices: RAM, ROM, SDRAM, flash, basic I/O interfaces.

Interfacing: Parallel ports, LEDs, pushbutton, keypad, 7-segment display, LCD display, touchscreen, timers and counters, serial Interface, networked embedded systems.

Embedded Programming Techniques: C-language primer, state machines, streams, circular buffers.

Development and Debugging: Development environment, hardware/software debugging techniques, performance analysis, use of hardware debugging modules.

Multiprocessor Embedded Systems: CPU and hardware acceleration, mutiprocessor performance analysis.

System Design Techniques: Design methodologies and flows, requirement analysis, specifications description, system analysis and architecture design, quality assurance.

Course Code: CSE 481

Course Title: Mobile Application Development

Credit hours: 3.00

Prerequisite: CSI 211, CSI 212

Contents: Introduction to mobile applications and Java overview.

Software Overview: API levels, installation, ADT and IDE.

App stores: Google Play, iTunes, Amazons etc.

Basic Building Blocks of a Mobile Application: Application framework, components, MVC architecture.

User Interfaces: Basic user interfaces, advanced user interface, widgets and layouts.

Activity and Activity Lifecycle: Passing data between activities, intents, advanced system components.

Database (SQLite), Networking, Multimedia and Content Providers: importing images, email/sms, call

Mapping and Location Based Services

Sensors: Accelerometer, light sensor, microphone, etc

Course Code: CSE 483

Course Title: Digital Image Processing

Credit hours: 3.00

Prerequisite:MATH 187, STAT 205, CSI 121

Contents: Digital image fundamentals:Visual perception, sensing, acquisition, sampling, quantization.
Intensity transformation and spatial filtering: Different transformations, histogram, correlation and convolution, smoothing and sharpening filters.
Filtering in frequency domain: Discrete-Fourier-Transformation (DFT) of image, smoothing and sharpening in frequency domain, selective filtering.
Image restoration and reconstruction: Noise models, spatial filtering for noise, frequency filtering for noise, reconstruction from projections.
Color image processing: Color models, color transformation and segmentation
Morphological image processing: Erosion, dilation, opening, closing, morphological algorithms.
Image compression: Redundancy, fidelity criteria, some basic compression techniques.
Image segmentation: Point, line and edge detection, thresholding, region based segmentation.
Object recognition: Matching, statistical classifier, neural networks
Analysis, design and visualization tools: MATLAB, IP toolbox, CV toolbox.

Course Code: CSE 485

Course Title: Game Design & Development

Credit hours: 3.00

Prerequisite:CSI 421, CSI 422

Contents:
Introduction to Game: Game Design Concepts, Character Modeling, Animation, Storyline, Graphics Programming using basic languages(C/C++/C#/Java), overview of Game Development tools, concepts of 3d virtual world

Introduction to Game Engine Pipeline: 3d mesh and 3d object modeling primer, compile time loading of game objects, real-time graphics rendering (animation), real-life physics simulation and collision detection, game state saving techniques and memory management

Introduction to Advanced Topics: Advanced data structures (Scene graph management using Quad Trees, Texturing using BumpMap, Random Terrain Generators with custom tweaking), Artificial Intelligence inside games etc.

Development of a Customize Game: Implementation of a game using industry standard tools.Implementing all the previously mentioned features for this game.

Optimization for Game and Graphics Rendering: Pre-Rendered optimization using state removal techniques, Compile-time optimization using advanced compiler techniques, Fluid Simulation using Shaders 3.0, Aerodynamic simulation usingNvidia Physics, Introduction to Ray Tracing for Lighting techniques.

Game Concepts in other Fields: Discussion on game development concepts in other fields - virtual reality, animated movies, physics simulation (Fluid/Aerodynamics simulation), simulation of A.I driven objects, particles collision detection etc.

Course Code: CSE 487

Course Title: Cloud Computing

Credit hours: 3.00

Prerequisite: None

Contents: Overview of Distributed Computing: Trends of computing, introduction to distributed computing, next big thing: Cloud computing.
Introduction to Cloud Computing: Cloud computing properties and characteristics, service models, deployment models.
Attributes of Cloud computing: Multi-tenancy – a single instance of software or other computing resource serving several clients, massive scalability – ability to support hundreds of thousands of

clients at the same time, elasticity – ability to grow or contract on demand, on-demand self-provisioning of resources.
Infrastructure-as-a-Service (IaaS): Introduction to IaaS, resource (i.e., server, storage and network) virtualization, case studies.
Platform-as-a-Service (PaaS): Introduction to PaaS. Cloud platform, management of computation and storage, case studies.
Software-as-a-Service (SaaS): Introduction to SaaS, Web services, Web 2.0, Web OS, case studies.
Cloud issues and challenges: Cloud provider lock-in or vendor lock-in, security of Cloud computing.

CSE 400 Project/Thesis

All candidates are required to undertake supervised study and research culminating in a Thesis/Project in their field of specialization.