Department of Computer Science and Engineering
B.Sc. (Engg.) Syllabus

Total Credits Required for Graduation: 160
No. of Years: 4
No. of Semesters: 12

First Year : *Semester I*

Course No	Course Title	Hours/Week Theory + Lab	Credits	Prerequisite
CSE 111	Fundamentals of Computers	3 + 0	3.0	
CSE 113	Structured Programming Language	3 + 0	3.0	
CSE 114	Structured Programming Language Lab	0 + 3	1.5	
ENG 101	English Language	3 + 0	3.0	
MAT 101	Calculus	3 + 0	3.0	
	Total	**12 + 3 = 15**	**13.5**	

First Year : *Semester II*

Course No	Course Title	Hours/Week Theory + Lab	Credits	Prerequisite
CSE 121	Basic Electrical Engineering	3 + 0	3.0	
CSE 122	Basic Electrical Engineering LAB	0 + 3	1.5	
CSE 123	Discrete Mathematics	3 + 0	3.0	
CHE 101	Fundamentals of Chemistry	3 + 0	3.0	
PHY 101	Mechanics, Wave, Heat & Thermodynamics	3 + 0	3.0	
	Total	**12 + 3 = 15**	**13.5**	

First Year : *Semester III*

Course No	Course Title	Hours/Week Theory + Lab	Credits	Prerequisite
CSE 131	Data Structure	3 + 0	3.0	CSE 113
CSE 132	Data Structure Lab	0 + 3	1.5	
MAT 103	Matrices, Vector Analysis and Geometry	3 + 0	3.0	
PHY 103	Electromagnetism and Optics	3 + 0	3.0	
GED 101	Bangladesh Studies	3 + 0	3.0	
	Total	**12 + 3 = 15**	**13.5**	

Second Year : *Semester I*

Course No	Course Title	Hours/Week Theory + Lab	Credits	Prerequisite
CSE 211	Object Oriented Programming Language	3 + 0	3.0	CSE 113
CSE 212	Object Oriented Programming Language Lab	0 + 3	1.5	
CSE 213	Electronic Devices and Circuits	3 + 0	3.0	CSE 121
CSE 214	Electronic Devices and Circuits LAB	0 + 3	1.5	
CSE 216	Engineering Drawings	0 + 4	2.0	
STA 201	Basic Statistics & Probability	3 + 0	3.0	
	Total	**9 + 10 = 19**	**14.0**	

Second Year: *Semester II*

Course No	Course Title	Hours/Week Theory + Lab	Credits	Prerequisite
CSE 221	Digital Logic Design	3 + 0	3.0	CSE 121, CSE 213
CSE 222	Digital Logic Design Lab	0 + 3	1.5	
CSE 223	Theory of Computation	3 + 0	3.0	
MAT 201	Numerical Methods	3 + 0	3.0	

ECO 201	Principles of Economics	3 + 0	3.0	
	Total	**12 + 3 =15**	**13.5**	

Second Year : *Semester III*

Course No	Course Title	Hours/Week Theory + Lab	Credits	Prerequisite
CSE 200	Project Work I	0 + 4	2.0	
CSE 231	Algorithm Design & Analysis	3 + 0	3.0	CSE 131
CSE 232	Algorithm Design & Analysis Lab	0 + 3	1.5	
BBA 201	Cost and Management Accounting	3 + 0	3.0	
MAT 203	Complex Variables, Laplace Transform and Fourier Series	3 + 0	3.0	
	Total	**9 + 7 = 16**	**12.5**	

Third Year : *Semester I*

Course No	Course Title	Hours/Week Theory + Lab	Credits	Prerequisite
CSE 311	Computer Architecture	3 + 0	3.0	
CSE 313	Database System	3 + 0	3.0	
CSE 314	Database System Lab	0 + 3	1.5	
CSE 315	Communication Engineering	3 + 0	3.0	
CSE 317	Simulation and Modeling	3 + 0	3.0	
	Total	**12 + 3 = 15**	**13.5**	

Third Year : *Semester II*

Course No	Course Title	Hours/Week Theory + Lab	Credits	Prerequisite
CSE 321	Microprocessor & Interfacing	3 + 0	3.0	CSE 213
CSE 322	Microprocessor & Interfacing Lab	0 + 3	1.5	
CSE 323	Management Information Systems	3 + 0	3.0	
CSE 325	Computer Networking	3 + 0	3.0	
CSE 326	Computer Networking Lab	0 + 3	1.5	
	Total	**9 + 6 = 15**	**12.0**	

Third Year : *Semester III*

Course No	Course Title	Hours/Week Theory + Lab	Credits	Prerequisite
CSE 300	Project work II	0 + 4	2.0	
CSE 331	Operating System and System Programming	3 + 0	3.0	
CSE 332	Operating System and System Programming Lab	0 + 3	1.5	
CSE 333	Software Engineering	3 + 0	3.0	
CSE 334	Software Engineering Lab	0 + 3	1.5	
CSE 335	Technical Writing And Presentation	3 + 0	3.0	
	Total	**9 + 10 = 19**	**14.0**	

Fourth Year : *Semester I*

Course No	Course Title	Hours/Week Theory + Lab	Credits	Prerequisite
CSE 411	Artificial Intelligence	3 + 0	3.0	
CSE 412	Artificial Intelligence Lab	0 + 3	1.5	
CSE 413	Web Engineering	3 + 0	3.0	
CSE 414	Web Engineering Lab	0 + 3	1.5	
CSE 4**	Option I	3 + 0	3.0	
CSE 4**	Option I Lab	0 + 3	1.5	
	Total	**9 + 9 = 18**	**13.5**	

Fourth Year: *Semester II*

Course No	Course Title	Hours/Week Theory + Lab	Credits	Prerequisite

CSE 400	Thesis / Project I	0 + 4	2.0	
CSE 421	Compiler Construction	3 + 0	3.0	CSE 223
CSE 422	Compiler Construction Lab	0 + 3	1.5	
CSE 423	Computer Graphics	3 + 0	3.0	
CSE 424	Computer Graphics Lab	0 + 3	1.5	
CSE 425	Cyber and Intellectual Property Law	3 + 0	3.0	
	Total	**9 + 10 = 19**	**14.0**	

Fourth Year: *Semester III*

Course No	Course Title	Hours/Week Theory + Lab	Credits	Prerequisite
CSE 402	Thesis/ Project II	0 + 4	2.0	
CSE 404	Viva Voce	0 + 3	1.5	
CSE 431	Digital Signal Processing	3 + 0	3.0	MAT 103, MAT 203
CSE 432	Digital Signal Processing Lab	0 + 3	1.5	
CSE 4**	Option II	3 + 0	3.0	
CSE 4**	Option II Lab	0 + 3	1.5	
	Total	**6 + 13 = 19**	**12.5**	

Optional : *Option I*

Course No	Course Title	Hours/Week Theory + Lab	Credits	Prerequisite
CSE 433	Digital Image Processing	3 + 0	3.0	
CSE 434	Digital Image Processing Lab	0 + 3	1.5	
CSE 435	Pattern Recognition	3 + 0	3.0	
CSE 436	Pattern Recognition Lab	0 + 3	1.5	
CSE 437	Fiber Optics	3 + 0	3.0	PHY 103
CSE 438	Fiber Optics Lab	0 + 3	1.5	
CSE 439	Advanced Data Structure and Algorithm	3 + 0	3.0	CSE 131, CSE 231
CSE 440	Advanced Data Structure and Algorithm Lab	0 + 3	1.5	
CSE 441	Cloud Computing	3 + 0	3.0	
CSE 442	Cloud Computing Lab	0 + 3	1.5	
CSE 443	Advanced Database System	3 + 0	3.0	CSE 313
CSE 444	Advanced Database System Lab	0 + 3	1.5	
CSE 445	Mobile and Wireless Communication	3 + 0	3.0	CSE 315
CSE 446	Mobile and Wireless Communication Lab	0 + 3	1.5	
CSE 447	VLSI Design	3 + 0	3.0	CSE 213
CSE 448	VLSI Design Lab	0 + 3	1.5	

Optional : *Option II*

Course No	Course Title	Hours/Week Theory + Lab	Credits	Prerequisite
CSE 449	Bio-informatics	3 + 0	3.0	CSE 231
CSE 450	Bio-informatics Lab	0 + 3	1.5	
CSE 451	Neural Networks and Fuzzy Systems			
CSE 452	Neural Networks and Fuzzy Systems			
CSE 453	Natural Language Processing	3 + 0	3.0	CSE 223
CSE 454	Natural Language Processing Lab	0 + 3	1.5	
CSE 455	Machine Learning	3 + 0	3.0	
CSE 456	Machine Learning Lab	0 + 3	1.5	
CSE 457	Parallel Processing And Distributed Computing Systems	3 + 0	3.0	
CSE 458	Parallel Processing And Distributed Computing Systems Lab	0 + 3	1.5	

CSE 459	Contemporary Course on Computer Science & Engineering	3 + 0	3.0
CSE 460	Lab on Contemporary Course on Computer Science & Engineering	0 + 3	1.5

Detailed Syllabus

CSE 111 FUNDAMENTALS OF COMPUTERS

3 Hours/Week, 3 Credits

Introduction to computations; early history of computing devices; computers; major components of a computer; Hardware: processor, memory, I/O devices; software: Operating system, application software; Basic architecture of a computer; Basic Information Technology; the Internet, Basic programming concepts: Number system: binary, octal, hexadecimal, decimal; binary arithmetic, program development stages, flow charts, programming constructs: data types, operators, expressions, statements, control statements, functions, array, Computer Networks, Internet, Communication media: twisted pair, coaxial cable, optical fiber, Networking devices.

Books:

1. Computer Science- Warford
2. Hardware Bible, Braddy Publishing, Indianpolis – L. Rosch
3. Inside the PC - P. Norton
4. Introduction to Computers - Subramanian
5. Introduction to Computer - P. Norton
6. Computer Fundamentals- Pradeep K. Sinha

CSE 113 STRUCTURED PROGRAMMING LANGUAGE

3 Hours/Week, 3 Credits

Programming Language: Basic concept, Overview of programming languages, Problem Solving Techniques and Data Flow Diagram. **C-Language:** Preliminaries, Program constructs, variables and data types in C. Input and output. Character and formatted I/O; Arithmetic Expressions and Assignment statements; Loops and Nested loops; Decision making; Arrays, Functions; Arguments and local variables, Calling Functions and arrays. Recursion and Recursive functions; Structures within structure. Files; File functions for sequential and Random I/O. Pointers; Pointers and structures; Pointer and functions; Pointer and arrays; Operation and Pointer; Pointer and memory addresses; Operations on Bits; Bit Operation; Bit field; Advanced features; Standard and library.

Books:

1. The C Programming Language- Kernigfhan and Ritchie
2. Programming with C, Schaum's Outline Series, THM – Gotfreid
3. A first Course on Computer Programming using Pascal, McGraw-hill, 1987 – M. Keller
4. The Art of Computer Programming – D.E. Knuth
5. The Complete reference, Turbo C/C++ - H. Schieldt
6. Programming with ANSI C- E. Balagurusamy
7. Teach yourself C- H. Schieldt

CSE 114 STRUCTURED PROGRAMMING LANGUAGE LAB

3 Hours /week, 1.5 Credits

Students should be able to solve different easy problems with their analysis using pen and papers and then doing code on computers just like expressing their speech using a language; they should also be able to calculate outputs for different inputs on papers before running the code that will prove their understanding of the logics behind the code.

Introduction: Introductory outputs using C. **Data Types and Operator:** Declaring variables of different data types and doing different types of operations on them, facing problems when internal result of calculation crosses the boundary of a data type. **Data Input/Output:** Variation and formats of getting input and giving output. **Control Statement:** Implementation of all types of control statement structures, odd/even test, find max/min from 2/3 numbers, generate grades from marks, floor, ceiling, absolute value, sum of n numbers using loop and calculate average, test prime, generate Fibonacci sequence. **Array, String and Nested Looping:** Finding the number of students getting marks above average, finding vowel and consonant from a given string, detecting palindrome, counting words of a string, reversing each words of a sentence, using different functions of string.h library, bubble sort, matrix multiplication, **Using Library Functions:** Functions from stdio.h, math.h, stdlib.h and ctype.h library. **Functions:** Doing some previous problems using function, implement call by value and call by reference, prime factorization. **Recursion:** Find Greatest Common Divisor, Fibonacci, Factorial, Tower of Hanoi. **Program Structure:** Use static and global variable. **Pointers:** Passing pointer to a function, dynamic memory allocation, arrays of pointers. **Structure and Union:** Sorting points (first according to x, then

according to y), using line segment structure (point structure inside line), using union. **File:** Opening, closing, creating and processing data files.

CSE 121 BASIC ELECTRICAL ENGINEERING

3 hours/Week, 3 Credits

Circuit variables and elements: Voltage, current, power, energy, independent and dependent sources, and resistance. Basic laws: Ohm's law, Kirchoff's current and voltage laws. Simple resistive circuits: Series and parallel circuits, voltage and current division, wye-delta transformation. Techniques of circuit analysis: Nodal and mesh analysis including super node and super mesh. Network theorems: Source transformation, Thevenin's, Norton's and superposition theorems with applications in circuits having independent and dependent sources, maximum power transfer condition and reciprocity theorem. Energy storage elements: Inductors and capacitors, series parallel combination of inductors and capacitors. Responses of RL and RC circuits: Natural and step responses.
Sinusoidal functions: Instantaneous current, voltage, power, effective current and voltage, average power, phasors and complex quantities, impedance, real and reactive power, power factor. Analysis of single phase AC circuits: Series and parallel RL, RC and RLC circuits, nodal and mesh analysis, application of network theorems in AC circuits

Textbook: Introductory circuit analysis by **Boylestad**

CSE 122 BASIC ELECTRICAL ENGINEERING LAB

3 hours/Week, *1.5* Credits

In this course students will perform experiments to verify practically the theories and concepts learned in EEE-109.
1. To familiar with the operation of different electrical instruments.
2. To verify the following theorems:
KCL and KVL theorem,
Superposition theorem,
Thevenin's theorem,
Norton's theorem and
Maximum power transfer theorem
3. RL and RC response.
5. Study the frequency response of an RLC circuit and find its resonant frequency.
6. Basic electrical element like fan, bulb, calling bell etc connection from 220v AC single phase supply.
7. Relevant application based on CSE 121.

CSE 123 DISCRETE MATHEMATICS

3 Hours/Week, 3 credits

Set, relations Functions: Set, Function, Representing Relations, Equivalence Relations
Propositional Calculus: Propositions, Predicate and Quantifier,
Algorithms: Complexity, Divisions, Algorithm, Application of Number Theory
Recursion: Sequences and summations, Recursive Definition and algorithm
Combinatorial Analysis: Permutation and Combination, Divide and Conquer Algorithms, Generating Functions
Graphs: Representation, Isomorphism, Connectivity, Euler and Hamilton path, Shortest path, Planer, Coloring, Trees.
Boolean Algebra: Number System, Boolean Function, representing Boolean Function, Logic gate, Minimization of Circuits

Books:

1. Theory and Problems of Discrete Mathematics, Schaum's outline series- Lipshutz
2. Elements of Discrete Mathematics, 2nd Ed, McGraw-Hill, 1985 – C. L. Liu
3. Discrete Mathematical Structure – Sharon Ross
4. Discrete Mathematics and its Applications – K. H. Rosen

CSE 131 DATA STRUCTURES

3 Hours/Week, 3 Credits

Internal Data Representation. Specification, representation and manipulation of basic data structures: arrays, records and pointers, linked lists, stacks, queues, recursion, trees, optimal search trees, heaps, disjoint sets. Graphs and their application, String processing. Searching, Sorting and Hashing techniques.

Books:

1. Data Structures – Seymour Lipschutz, Schaum's Outlines Series-Lipshultz.
2. Fundamental of Data Structures, Galgotia- E. Horowitz and S. Sahni
3. Data Structures- Reingold

CSE 132 DATA STRUCTURE LAB

4 Hours/Week , 1.5 Credits

Using a programming language, creating and manipulating various linear data structures: linked list, stacks and queues.
Creating and manipulating non-linear data structures: B-trees and heaps, disjoint set.
Implementing sorting, searching and hashing techniques, string processing.

CSE 211 OBJECT ORIENTED PROGRAMMING LANGUAGE
3 Hour/week, 3 Credits

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

Books:

1. Java How to Program- H. M. Deitel, P. J. Deitel
2. Core Java (Vol. 1 and 2)- Sun Press
3. Beginning Java 2, Wrox- Ivor Horton
4. Java 2 Complete Reference, Jessey- H. Schildt

CSE 212 OBJECT ORIENTED PROGRAMMING LANGUAGE LAB.
3 Hours/Week, 1.5 Credits

Object-Oriented Programming: Classes and objects, Constructors and destructor, Encapsulation of class members and methods, Manipulating objects. **Dynamic Memory Allocation:** Pointers to objects, Pointers and arrays, Call-by-reference and call-by-value. **Concept of Inheritance, Interface and Polymorphism:** Direct and indirect inheritance, Private and protected members of inherited class, Constructors and destructors under inheritance, Polymorphism, Abstract base classes. **Exceptions:** Error handing in program, Creating own exception. **Handing Files:** Input/Output streams, Processing files, Random access files. **Thread Programming:** Introduction to threads, Using threads to solve multi-tasking problems, Thread synchronization. **Client-Server programming:** Applet and Servlets, Introduction to JSP, Socket programming. GUI: Basic user interface design using Java swing.
Understanding Java Enterprise Level Works.

CSE 213 ELECTRONIC DEVICES & CIRCUITS
3 hours/Week, 3 Credits

P-N junction as a circuit element: Intrinsic and extrinsic semiconductors, operational principle of p-n junction diode, contact
potential, current-voltage characteristics of a diode, Diode circuits: Half wave and full wave rectifiers, rectifiers with filter capacitor, characteristics of a Zener diode, clamping and clipping circuits.
Bipolar Junction Transistor (BJT) as a circuit element: current components, BJT characteristics and regions of operation, BJT as an amplifier, biasing the BJT for discrete circuits, small signal equivalent circuit models, BJT as a switch.
Metal Oxide Semiconductor Field Effect Transistor (MOSFET) as circuit element: structure and physical operation of an enhancement MOSFET, threshold voltage, Body effect, current-voltage characteristics of an enhancement MOSFET, biasing discrete and integrated MOS amplifier circuits, single-stage MOS amplifiers, MOSFET as a switch, CMOS inverter.
Operational amplifiers (Op-Amp): Properties of ideal Op-Amps, non-inverting and inverting amplifiers, inverting integrators, differentiator, weighted summer and other applications of Op-Amp circuits.
Introduction to photodiode, Laser, Solar cell, Photo detector, LED.

Textbook: Electronics Devices by R. L. Boylestad

CSE 214 ELECTRONIC DEVICES & CIRCUITS LAB
3 hours/Week, *1.5* Credits

Students will also perform different experiments based on CSE 213.

To familiar with electronics devices and Laboratory Equipments.
To study of V-l Characteristics curve of P-N junction diode.
To study of Half-Wave Rectification circuit.
To study of Full-Wave Rectification circuit (Bridge & Center- tap).
To study of Clipping and clamping circuit.
To study MosFET and BJT characteristics.
Speech/ Audio amplification using NPN/PNP Transistor.
MosFET as an amplifier and switch.
Different operational amplifier circuits.

CSE 216 ENGINEERING DRAWINGS
4 hours/Week, 2.0 Credits

The aim of this course is to introduce students the basic concepts and the use of engineering drawing in the design and manufacturing field. The students acquaint with the basic knowledge and skills in engineering drawings and the capability to read and interpret blue prints for manufacturing. The students can also develop an understanding of 2D and 3D computer aided drafting with the requirements of good engineering drawings and be able to apply them to their work.

It is essential to know the technical drawing rules before starting CAD-CAM programs. Using computers at the beginning of the engineering education will help the students visualize engineering components. Appropriate sketching exercises will be done during practice hours by using a package program namely AutoCAD. The CAD software should be perceived by the student as a tool for producing engineering drawings. However, it should be strongly felt that students should design shapes that suited the purpose and manufacturing methods rather than being driven by the software capabilities. Note that CSE 134 is not AutoCAD course but an engineering drawing course.

CSE 221 DIGITAL LOGIC DESIGN
3 Hours/Week , 3.0 Credits

Digital logic: Boolean algebra, De Morgan's Theorems, 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: asynchronous counters, synchronous 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.

CSE 222 DIGITAL LOGIC DESIGN LAB
3 Hours/Week , 1.5 Credits

Laboratory works based on CSE 221.

CSE 223 THEORY OF COMPUTATION
3 Hours/Week , 3.0 Credits

Finite Automata: Deterministic and nondeterministic finite automata and their equivalence. Equivalence with regular expressions. Closure properties. The pumping lemma and applications. **Context-free Grammars:** Definitions. Parse trees. The pumping lemma for CFLs and applications. Normal forms. General parsing. Sketch of equivalence with pushdown automata. **Turing Machines:** Designing simple TMs. Variations in the basic model(multi-tape, multi-head, nondeterminism). Church-Turing thesis and evidence to support it through the study of other models. **Undecidability:** The undecidability of the halting problem. Reductions to other problems. Reduction in general.

Books:
1. *Introduction to Languages and the Theory of Computation*, 2nd Edition - J. C. *Martin, McGraw Hill Publications, 1997.*
2. Concrete Mathematics – Donald L. Graham, Donald E. Knuth, Oren Patashnik.

CSE 231 ALGORITHM DESIGN AND ANALYSIS
3 Hours/Week , 3.0 Credits

Analysis of Algorithm:
Asymptotic analysis: Recurrences, Substitution method, Recurrence tree method, Master method
Divide-and-Conquer: Binary search, Powering a number, Fibonacci numbers, Matrix Multiplication, Strassen's Algorithm for Matrix Multiplication.
Sorting: Insertion sort, Merge sort, Quick sort, Randomized quick sort, Decision tree, Counting sort, Radix sort.
Order Statistics: Randomized divide and conquer, worst case linear time order statistics.
Graph: Representation, Traversing a graph, Topological sorting, Connected Components.
Dynamic Programming: Elements of DP (Optimal substructure, Overlapping subproblem), Longest Common Subsequence finding problem, Matrix Chain Multiplication.

Greedy Method: Greedy choice property, elements of greedy strategy, Activity selector problem, Minimum spanning tree (Prims algorithm, Kruskal algorithm), Huffman coding.
Shortest Path Algorithms: Dynamic and Greedy properties, Dijkstra's algorithm with its correctness and analysis, Bellman-ford algorithm, All pair shortest path: Warshall's algorithm, Johnson's algorithm
Network flow: Maximum flow, Max-flow-min-cut, Bipartite matching.
Backtracking/Branch-and-Bound: Permutation, Combination, 8-queen problem, 15-puzzle problem.
Geometric algorithm: Segment-segment intersection, Convex-hull, Closest pair problem.
And NP Completeness, NP hard and NP complete problems.

Books:

1. The Art of Computer Programming, Fundamental Algorithms, Vol. 1- D. E. Knuth
2. The Art of Computer Programming, Semi numerical Algorithms, Vol. 2- D. E. Knuth
3. The Art of Computer Programming, Sorting and Searching, Vol. 3- D. E. Knuth
4. Introduction to Design and Analysis of Algorithms- Goodman
5. Algorithms- Robert Sedgewick
6. Fundamentals of Computer Algorithms- E. Horowitz and S. Sahni
7. Introduction to Algorithms- Thomas H. Kormen

CSE 232 ALGORITHMS DESIGN AND ANALYSIS LAB
3 Hours/Week, 1.5 Credits

Using different well known algorithms to solve the problem of Matrix-Chain Multiplication, Longest Common Subsequence, Huffman codes generation, Permutation, Combination, 8-queen problem, 15-puzzle, BFS, DFS, flood fill using DFS, Topological sorting, Strongly connected component, finding minimum spanning tree, finding shortest path (Dijkstra's algorithm and Bellman-Ford's algorithm), Flow networks and maximum bipartite matching, Finding the convex hull, Closest pair.

CSE 200 PROJECT WORK I
4 Hours/Week, 2.0 Credits

Project focusing on Object oriented programming approach and using standard algorithm is preferable. Every project should maintain a goal so that it can be used as a useful tool in the IT fields. Also innovative project ideas that require different types scripting/programming languages or programming tools can be accepted with respect to the consent of the corresponding project supervisor.

CSE 311 COMPUTER ARCHITECTURE
3 Hours/Week, 3.0 Credits

Introduction to Computer Architecture: Overview and history; Cost factor; Performance metrics and evaluating computer designs. **Instruction set design:** Von Neumann machine cycle, Memory addressing, Classifying instruction set architectures, RISC versus CISC, Micro programmed vs. hardwired control unit. **Memory System Design:** Cache memory; Basic cache structure and design; Fully associative, direct, and set associative mapping; Analyzing cache effectiveness; Replacement policies; Writing to a cache; Multiple caches; Upgrading a cache; Main Memory; Virtual memory structure, and design; Paging; Replacement strategies. **Pipelining:** General considerations; Comparison of pipelined and nonpipelined computers; Instruction and arithmetic pipelines, Structural, Data and Branch hazards. **Multiprocessors and Multi-core Computers:** SISD, SIMD, and MIMD architectures; Centralized and distributed shared memory- architectures; Multi-core Processor architecture. Input/output Devices: Performance measure, Types of I/O device, Buses and interface to CPU, RAID. Pipelining: Basic pipelining, Pipeline Hazards. Parallel Processing.

Books:
John P.Hayes, "Computer Architecture and Organization", 3rd Edition, McGraw Hill
David A.Patterson and John L.Hennessy, "Computer Organization and Design: The hardware / software interface"

CSE 313 DATABASE SYSTEM
3 Hours/Week , 3.0 Credits

Introduction: Purpose of Database Systems, Data Abstraction, Data Models, Instances and Schemes, Data Independence, Data Definition Language, Data Manipulation Language, Database Manager, Database administrator, Database Users, Overall System Structure, Advantages and Disadvantage of a Database Systems. *Data Mining and analysis, Database Architecture, History of Database Systems*
Relationship Entity-Model: Entities and Entity Sets, Relationships and Relationship Sets, Attributes, *Composite and Multivalued Attributes,* Mapping Constraints, Keys, Entity-Relationship Diagram, Reducing of

E-R Diagram to Tables, Generalization, *Attribute Inheritance*, Aggregation, *Alternative E-R Notatios*, Design of an E-R Database Scheme.
Relational Model: Structure of Relational Database, *Fundamental Relational Algebra Operations*, The Tuple Relational Calculus, The Domain Relational Calculus, Modifying the Database.
Relational Commercial Language: *SQL, Basic structure of SQL Queries, Query-by-Example, Quel., Nested Sub queries, Complex queries, Integrity Constraints, Authorization, Dynamic SQL, Recursive Queries.*
Relational Database Design: Pitfalls in Relational Database Design, *Functional Dependency Theory*, Normalization using Functional Dependencies, Normalization using Multivalued Dependencies, Normalization using join Dependencies, *Database Design Process*.
File And System Structure: Overall System Structure, Physical Storage Media, File Organization, *RAID*, Organization of Records into Blocks, Sequential Files, Mapping Relational Data to Files, Data Dictionary Storage, Buffer Management.
Indexing And Hashing: Basic Concepts, *Ordered Indices*, B+ -Tree Index Files, B-Tree Index Files, Static and Dynamic Hash Function, Comparison of Indexing and Hashing, Index Definition in SQL, Multiple Key Access.
Query Processing *and Optimization*: Query Interpretation, Equivalence of Expressions, Estimation of Query-Processing Cost, Estimation of Costs of Access Using Indices, Join Strategies, Join Strategies for parallel Processing, Structure of the query Optimizer, *Transformation of Relational Expression*
Concurrency Control: Schedules, Testing for Serializability, Lock-Based Protocols, Timestamp-Based Protocols, Validation Techniques, Multiple Granularity, Multiversion Schemes, Insert and Delete Operations, *Deadlock Handling*
Distributed Database: Structure of Distributed Databases, Trade-off in Distributing the Database, Design of Distributed Database, Transparancy and Autonomy, Distributed Query Processing, Recovery in Distributed Systems, Commit Protocols, Concurrency Control.

Data Mining and Information Retrieval*:* *Data analysis and OLAP, Data Warehouse, Data Mining, Relevance Ranking Using Terms, Relevance Ranking Using Hyperlink, Synonyms, Homonyms, Ontology, Indexing of Document, Measuring Retrieval Efficiencies, Information Retrieval and Structured Data.*

Books:

1. Database System Concepts – Abraham Silberschratz, Henry K. Korth, S. Sudarshan (5^{th} edition)
2. Fundamentals of Database Systems - Benjamin/Cummings, 1994
3. Database Principles, Programming, Performance - Morgan Kaufmann 1994
4. A First Course in Database Systems - Prentice Hall, 1997
5. Database Management Systems, McGraw Hill, 1996

CSE 314 DATABASE SYSTEM LAB
3 Hours/Week, 1.5 Credits

Introduction: What is database, MySQL , Oracle , SQL, Datatypes, SQL / PLSQL, Oracle Software Installation, User Type, Creating User , Granting.
Basic Parts of Speech in SQL: Creating Newspaper Table, Select Command (Where , order by), Creating View, Getting Text Information & Changing it, Concatenation, Cut & paste string(RPAD , LPAD , TRIM , LTRIM , RTRIM, LOWER , UPPER , INIT, LENGTH , SUBSTR , INSTR , SOUNDEX).
Playing The Numbers: Addition , Subtraction , Multiplication , Division, NVL , ABS , Floor , MOD , Power , SQRT , EXR , LN , LOG , ROUND, AVG , MAX , MIN , COUNT , SUM, Distinct, SUBQUERY FOR MAX,MIN.
Grouping things together: Group By , Having, Order By, Views Renaming Columns with Aliases.
When one query depends upon another: Union, Intersect , Minus, Not in , Not Exists.
Changing Data : INSERT,UPDATE,MERGE,DELETE, ROLLBACK , AUTOCOMMIT , COMMIT, SAVEPOINTS, MULTI TABLE INSERT, DELETE, UPDATE, MERGE.
Creating And Altering tables & views: Altering table, Dropping table, Creating view, Creating a table from a table.
By What Authority: Creating User, Granting User, Password Management.
An Introduction to PL/SQL: Implement few problems using PL/SQL (eg Prime Number, Factorial, Calculating Area of Circle, etc).
An Introduction to Trigger and Procedure: Implement few problems using Trigger and Procedures.
An Introduction to Indexing: Implement indexing using a large database and observe the difference of Indexed and Non-Indexed database.

CSE 315 COMMUNICATION ENGINEERING
3 Hours/Week, 3.0 Credits

Introduction: Data communications, Networks, Internet, Protocols and Standards.
Network Models: OSI Model, TCP/IP Protocol suite, Addressing
Data and Signals: Analog and Digital data, Analog and Digital Signals, Time and Frequency Domain, Transmission impairments, Data rate limits, Performance
Digital Transmission: Digital-to-Digital Conversion, Analog-to-Digital Conversion, Transmission Modes
Analog Transmission: Digital-to-Analog Conversion, Analog-to-Analog Conversion.

Multiplexing and Spread Spectrum: FDM, WDM, TDM, STDM, Digital Subscriber Line, FHSS, DSSS.
Transmission Media: Guided and Unguided Media
Switching: Circuit switching, Packet switching.
Data Link Layer: Error Detection and Correction, Data Link Control, Framing, Flow and Error Control.
Multiple Access: CSMA, CSMA/CD, CSMA/CA, FDMA, TDMA, CDMA.
Books:

1. Data Communications and Networking – Behrouz A. Forouzan (4th edition)
2. Data and Computer Communications - W Stallings, Macmillan, 1994 (4th edition)
3. Computer networks - A. S. Tanenbaum, Addison-Wesley, 1996 (3rd edition) 4
4. Data Communication and Computer Network - Stawling

CSE 317 SIMULATION AND MODELING
3 Hours/Week, 3.0 Credits

Simulation modeling basics: systems, models and simulation; Classification of simulation models; Steps in a simulation study; Concepts in discrete-event simulation: event scheduling vs. process-interaction approaches, Time-advance mechanism, organization of a discrete-event simulation model; Continuous simulation models; Combined discreet continuous models; Monte Carlo simulation; Simulation of queuing systems. Building valid and credible simulation models: validation principles and techniques, statistical procedures for comparing real-world observations and simulation outputs, input modeling; Generating random numbers and random variates; Output analysis. Simulation languages; Analysis and modeling of some practical systems. Concepts covered in lecture applied in computer laboratory assignments.

CSE 321 MICROPROCESSORS & INTERFACING
3 Hours/Week, 3.0 Credits

Microprocessors: Concept of microprocessor; Evolution of microprocessors; Internal architecture of Intel 8085, 8086/8088 microprocessors: Instruction set and format, Programming in machine and assembly languages, Interrupt structure, DMA, I/O operation, Microprocessor interface ICs, Peripheral interfacing, Microprocessor based system design, Coprocessor, Multiprocessor system; Intel 80286, 80386 microprocessors: memory management scheme, Protection mechanism, 80386 modes; Advanced microprocessors. Bus System: ISA, EISA, PCI AGP, Memory Bus. Centronics, SCSI, USB and GPIB standards. Interfacing with analog world: A/D conversion, digital ramp ADC, successive approximation ADC, flush ADC, tristate ADC, D/A converter, DAC specifications, DAC applications, Data acquisition, sample-and-hold circuits, Stepper Motor, Transducers, printers, motors and peripherals.

CSE 322 MICROPROCESSORS & INTERFACING LAB
3 Hours/Week , 1.5 Credits

1. Registers, JMP, LOOP, CMP instruction, Conditional Jump instruction
2. Implementation of different types of instruction(rotating, shifting)
3. Instructions (MUL, IMUL, DIV, IDIV, CBW, CWD, Arrays, XLAT)
4. String instructions, macro handling
5. Bios Interrupt, Dos Interrupt
6. The IN, OUT, INS, and OUTS instruction
7. Processor signal from photodiode
8. Control of stepper motor using parallel port
9. Location detection using GPS through USB port

CSE 323 MANAGEMENT INFORMATION SYSTEMS
3 Hours/Week, 3.0 Credits

Introduction to MIS: Management Information System Concept. Definitions, Role of MIS, Approaches of MIS development. MIS and Computer: Computer Hardware for Information System, Computer Software for Information System, Data Communication System, Database Management Technology, Client-Server Technology. Decision-Support System: Introduction, Evolution of DSS, Future development of DSS. Application of MIS: Applications in manufacturing Sector, Applications in service sector, Case Studies.

CSE 325 COMPUTER NETWORKING
3 Hours/Week, 3.0 Credits

Introduction: Introduction to Computer Networks, Network Goals, Applications of Networks, Network Structure, Network Architectures, The OSI Reference Model, Data Transmission in the OSI Model, OSI Terminology, The ARPANET.
Local Area Network : LAN Technology - Architecture, Topology.
Wired LANs: Ethernet and Fast-Ethernet, Token Ring, FDDI.
Wireless LANs: IEEE 802.11, Bluetooth. Backbone Networks, Virtual LANs.

Wide Area Network: SONET, Virtual Circuit Networks - Frame Relay, ATM and ATM LANs.
Network Layer: Logical Addressing,
Internet Protocol: Internetworking, Routing Protocol, IPv4 and IPv6.
Address Mapping, Error Reporting and Multicasting: ICMP, IGMP, ICMv6. Delivery, Forwarding and Routing.
Transport Layer: Process-to-Process delivery, Transport Services, Protocol mechanisms, TCP, UDP, SCTP, Congestion and QoS.
Application Layer: Domain Name System, Abstract Syntax Notation One (ASN.1), Network Management - SNMPv2, Electronic mail - SMTP and MIME, Uniform Resource Locator (URL) and Universal Resource Identifier (URI), Hypertext Transfer Protocol (HTTP).
Wireless and Mobile Networking: Wireless Networking: Issues and Trends, Wireless Physical Layer Concepts , Wireless Cellular Networks, Mobile IP - IPv4, IPv6, TCP over Wireless, Ad Hoc Networks: Issues and Routing, Wireless Sensor Networks, Wireless Mesh and Multi-Hop Relay Networks, Wireless Network Security, Energy Management in Ad Hoc Wireless Networks.
Network Security: Security requirements and attacks, Privacy with conventional encryption, Message Authentication and Hash functions, Public-key encryption and digital signatures, Ipv4 and Ipv6 security.

Books:

1. Data Communications and Networking – Behrouz A. Forouzan (4th edition)
2. Data and Computer Communications - W Stallings, Macmillan, 1994 (4th edition)
3. Computer networks - A. S. Tanenbaum, Addison-Wesley, 1996 (3rd edition)
3. Data Communication and Computer Network - Stawling

CSE 326 COMPUTER NETWORKING LAB
3 Hours/Week, 1.5 Credits

Subnetting and designing a network using Packet Tracer.
Analysis of the TCP/IP behavior.
Packet analysis.
Server configuration: DHCP, SMTP, FTP, Web
Switch and Router Configuration.
Socket Programming

CSE 331 OPERATING SYSTEM and SYSTEM PROGRAMMING
3 Hours/Week, 3.0 Credits

Introduction: Operating Systems Concept, Computer System Structures, Operating System Structures, Operating System operations, Protection and Security, Special-Purpose Systems.
Fundamentals of OS : OS services and components, multitasking, multiprogramming, time sharing, buffering, spooling
Process Management: Process Concept, Process Scheduling, Process State, Process Management, Interprocess Communication, interaction between processes and OS, Communication in Client-Server Systems, Threading, Multithreading, Process Synchronization.
Concurrency control: Concurrency and race conditions, mutual exclusion requirements, semaphores, monitors, classical IPC problem and solutions, Dead locks - characterization, detection, recovery, avoidance and prevention.
Memory Management: Memory partitioning, Swapping, Paging, Segmentation, Virtual memory - Concepts, Overlays, Demand Paging, Performance of demand paging, Page replacement algorithm, Allocation algorithms.
Storage Management: Principles of I/O hardware, Principles of I/O software, Secondary storage structure, Disk structure, Disk scheduling, Disk Management, Swap-space Management, Disk reliability, Stable storage implementation.
File Concept: File support, Access methods, Allocation methods, Directory systems, File Protection, Free Space management
Protection & Security *:* Goals of protection, Domain of protection, Access matrix, Implementation of access matrix, Revocation of access rights, The security problem, Authentication, One-time passwords, Program threats, System threats, Threat monitoring, Encryption, Computer-security classification.
Distributed Systems : Types of Distributed Operating System, Communication Protocols, Distributed File Systems, Naming and Transparency, Remote File Access, Stateful Versus Stateless Service, File Replication.
Case Studies: Study of a representative Operating Systems,
System Programming: Introduction to System Programming and Linux / Unix, Shell Programming, C Language for System Programming, Make and Make files, Process and Signals, Threads, Inter process Communications, X- Window Programming, Principle of single and multi user operating systems.

Books:

1. Operating System Concepts – Silberschatz & Galvin Wiley 2000 (7th Edition)
2. Operating Systems - Achyut S. Godbole Tata Mc Graw Hill (2nd Edition)
3. Understanding Operating System - Flynn & Metioes Thomsan (4th Edition)
4. Operating Systems Design & Implementation - Andrew Tanenbam, Albert S. Woodhull Pearson
5. Modern Operating System - Andrew S. Tanenbaum.

CSE 332 OPERATING SYSTEMS and SYSTEM PROGRAMMING LAB
3 Hours/Week, 1.5 Credits

Thread programming: Creating thread and thread synchronization.
Process Programming: The Process ID, Running a New Process, Terminating a Process, Waiting for Terminated Child Processes, Users and Groups, Sessions and Process Groups
Concurrent Programming: Using fork, exec for multi-task programs.
File Operations: File sharing across processes, System lock table, Permission and file locking, Mapping Files into Memory, Synchronized, Synchronous, and Asynchronous Operations, I/O Schedulers and I/O Performance.
Communicating across processes: Using different signals, Pipes, Message queue, Semaphore, Semaphore arithmetic and Shared memory.

Books:

1. The 'C' Odyssey UNIX-The Open, Boundless C – Meeta Gandhi, Tilak Shetty, Rajiv Shah.
2. Beginning Linux Programming – Neil Matthew and Richard Stones
3. Linux System Programming – Robert Love

CSE 333 SOFTWARE ENGINEERING
3 Hours/Week, 3.0 Credits

Introduction: Overview of Software Industry, Introduction to Software Engineering, Software Development Process and Various Life Cycle Models. **Requirement Analysis:** Communication Techniques, Analysis Principles, Software Prototyping, Requirement Specification. **Group Dynamics:** Working in Teams, Characteristics of Successful Team, Understanding Group Dynamics, Team Roles and Temperament, Democratic Team and Chief Programmer Team Approach. **Introduction to Extreme Programming**, **Analysis Modeling:** Steps of system analysis, Feasibility study, Economic and technical analysis, System specification, the elements of analysis model, Data modeling, Functional modeling and information flow, Behavioral modeling, Mechanics of structured analysis, Data Dictionary. **Software Design:** Design principles, Design Concepts, effective modular design, design heuristics, Data Design, Architectural Design process, Transformation mapping, Transaction mapping, interface design, human-computer interface design, procedural design. **Software Testing:** Testing fundamentals, test case design, white-box testing, black-box testing, testing GUIs, Unit testing, Integration testing, validation testing, system testing, debugging. **Maintenance:** Major maintenance activities, estimating maintenance cost and productivity. **Technical Metrics for Software:** Software quality, Framework for technical metrics, metrics for analysis and design models, source code, testing and maintenance. **Software Architecture:** Pipe and Filter, Object Oriented, Event Based, Layered System, Data-centered repository, Process Control Architectures, **Objet Oriented Software Engineering**: O-O concepts, O-O analysis, Domain analysis, O-O analysis process, Object relational model. O-O design: system design process, object design process, O-O programming. **O-O Testing:** Testing strategies, test case design. **Service Oriented Software Engineering:** Introduction to SOA, SOAP, Analysis, design, validation, verification, implementation and maintenance of service oriented software; ESB, Messaging Architecture, Software Tools for SOA. **Software Project Management:** Cost estimation, risk analysis, project scheduling. **Introduction to CASE Tools:** What is CASE, taxonomy of CASE tools, iCASE environment, CASE repository, Example CASE tools. **Intellectual Properties:** Trade Marks, Copy Rights, Trade Secrets, Patents, **Introduction to UML**.

Books:

1. Software Engineering, A practitioner's Approach, Second Edition- Roger S. Pressman
2. Software Engineering Concepts- Richard Fairley
3. Software Engineering Environments- Robert N. Charette
4. Software Engineering- Ian Sommerville

CSE 334 SOFTWARE ENGINEERING LAB
3 Hours/Week, 1.5 Credits

Software Engineering lab works is solely designed to attain hands on experience of architectural design, documentation and testing of software so that students can develop the software following the documents only.
Step1 (Requirement Engineering): Choose a company/institute/client for which software will be developed (make sure that they will provide required information whenever necessary). Follow the steps for eliciting requirements and generate use-case diagram. Also analyze the sufficiency of the requirement engineering outcome for steps to follow.
Step 2 (Analysis model to Architectural and Component level design): Generate Activity diagram, Data flow diagram (DFD), Class diagram, State diagram, Sequence diagram and follow other relevant steps for creating complete architectural and component level design of the target software.
Step 3 (User Interface design, Design evaluation, Testing strategies and Testing Tactics): Perform the user interface design with the help of swimlane diagram. Carry out the design evaluation steps. Generate all test cases for complete checking of the software using black box, white box testing concept.
Step 4 Software testing and debugging
Step 5 (Managing Software Projects): Analyze the estimation and project schedule.

CSE 335 TECHNICAL WRITING AND PRESENTATION
3 Hours/Week, 3.0 Credits

Issues of technical writing and effective oral presentation in Computer Science and Engineering; Writing styles of definitions, propositions, theorems and proofs; Preparation of reports, research papers, theses and books: abstract, preface, contents, bibliography and index; Writing of book reviews and referee reports; Writing tools: LATEX; Diagram drawing software; presentation tools.

CSE 300 PROJECT WORK II
***4** Hours/Week, 2.0 Credits*

Projects must possess innovative ideas which reflect contemporary IT trends. Supervisor have to ensure that every accepted project contain basic level of research work. Students have to give a presentation on their project works. Departments should take appropriate steps to archive all the projects and keep tracks to maintain the genuineness of the projects.

CSE 411 ARTIFICIAL INTELLIGENCE
3 Hours/Week, 3.0 Credits

What is Artificial Intelligence: The AI problems, The underlying assumption, What is an AI technique. **Problems, Problem spaces and Search:** Defining the problem as a state space search, Production system, Problem characteristics. **Heuristics Search Techniques:** Generate and Test, Hill climbing, Best First Search, Problem Reduction, Constraint Satisfaction, Means-Ends Analysis. **Knowledge Representation Issues:** Representation and Mappings, Approaches to knowledge Representation, Issues in Knowledge representation. **Using Predicate logic:** Representing simple facts in logic, Representing Instance and Isa relationships, Computable functions and Predicates, Resolution. **Representing Knowledge using Rules:** Procedural versus Declarative Knowledge, Logic Programming, Forward versus Backward Reasoning, Matching. **Game playing:** Overview, The Mimimax Search Procedure, Adding Alpha-Beta cutoffs, Additional refinements, iterative Deepening, **Planning:** Overview, An example Domain: The Blocks

World, Components of a planning system, Goal stack planning, **Understanding:** What is Understanding, What makes Understanding hard, Understanding as constraint satisfaction. **natural Language Processing:** Introduction, Syntactic Processing, Semantic Analysis, Discourse and Pragmatic Processing. **Expert systems:** representing and using domain knowledge, Expert system shells explanation, Knowledge Acquisition.
AI Programming Language: Python, Prolog, LISP

Books
1. Introduction to Artificial Intelligence and Expert Systems- Dan W. Patterson
2. Artificial Intelligence, Tata-MacGraw-Hill Publication Co. Ltd.- E. Rich and K. Knight
3. Artificial Intelligence Using C, Osborne-Mc-Graw-Hill- H. Schildt
4. An Introduction to Neural Computing, Adam Hilger Pub- C. F. Chabris and T. Jackson
5. Artificial Intelligence: A Modern Approach- S. Russel & P. Norvig

CSE 412 ARTIFICIAL INTELLIGENCE LAB
3 Hours/Week, 1.5 Credits

Students will have to understand the functionalities of intelligent agents and how the agents will solve general problems. Students have to use a high-level language (Python, Prolog, LISP) to solve the following problems:
Backtracking: State space, Constraint satisfaction, Branch and bound. Example: 8-queen, 8- puzzle, Crypt-arithmetic. **BFS and production:** Water jugs problem, The missionaries and cannibal problem. **Heuristic and recursion:** Tic-tac-toe, Simple bock world, Goal stack planning, The tower of Hanoi. **Question answering:** The monkey and bananas problem.

CSE 413 WEB ENGINEERING
3 Hours/Week, 3.0 Credits

Introduction to Web Engineering, Requirements Engineering and Modeling Web Applications, Web Application Architectures, Technologies and Tools for Web Applications, Testing and Maintenance of Web Applications, Usability and Performance of Web Applications, Security of Web Applications, The Semantic Web.

Books:
1. Web Engineering: The Discipline of Systematic Development of Web Applications Editors: Gerti Kappel, Birgit Pröll, Siegfried Reich, Werner Retschitzegger
2. Web Engineering: A Practioner's Approach, Roger Pressman, David Lowe
3. MIT Open Course Materials for the course Software Engineering for Web Applications
4. MIT Open Course Materials for the course Database, Internet, and Systems Integration Technologies

CSE 414 WEB ENGINEERING LAB
3 Hours/Week, 1.5 Credits

Understanding the Web application: Web Engineering introduces a structured methodology utilized in software engineering to Web development projects. The course addresses the concepts, methods, technologies, and techniques of developing Web sites that collect, organize and expose information resources. Topics covered include requirements engineering for Web applications, design methods and technologies, interface design, usability of web applications, accessibility, testing, metrics, operation and maintenance of Web applications, security, and project management. Specific technologies covered in this course include client-side (XHTML, JavaScript, and CSS) and server-side (Perl and PHP). Using the described concepts students should be able to understand the Web engineering concepts behind the frameworks of Joomla, Drupal, Wordpress.
Server-side technology: LAMP, Web application frameworks (example: Silverlight, Adobe Flex), Web 2.0 and Web APIs. **Front-end technology:** HTML, XHTML, XML. CSS styling, layout, selector, Document object model and JavaScript. **Client-Programming:** Web APIs with JavaScript (example: Google Ajax API). **MVC:** Understanding Model, view and controller Model. **Understanding Web APIs:** REST, XML, JSON, RSS Parsing.
JavaScript Exercise: The goal of this assignment is to allow you to explore and use as many of JavaScript's objects, methods, and properties as possible in a small assignment. Some functions must be written from scratch. Other functions, appropriately attributed, may be downloaded from the web and used as a part of the system or as the basis for your own functions. **PHP Exercise:** Build a set of PHP scripts that perform some dynamic server side functionality. **Understanding plug-ins:** Develop a Firefox extension.

CSE 421 COMPILER CONSTRUCTION
3 Hours/Week, 3.0 Credits

Introduction to compilers: Introductory concepts, types of compilers, applications, phases of a compiler. **Lexical analysis:** Role of the lexical analyzer, input buffering, token specification, recognition of tokens, symbol tables. **Parsing:** Parser and its role, context free grammars, top-down parsing. **Syntax-directed translation:** Syntax-directed definitions, construction of syntax trees, top-down translation. **Type checking:** Type systems, type expressions, static and dynamic checking of types, error recovery. **Run-time organization:** Run-time storage organization, storage strategies. **Intermediate code generation:** Intermediate languages, declarations, assignment statements. **Code optimization:** Basic concepts of code optimization, principal sources of optimization. **Code generation. Features of some common compilers:** Characteristic features of C, Pascal and Fortran compilers.

Books:

1. **Compilers: Principles, Techniques, and Tools** – Alfred V. Aho, Ravi Sethi, Jeffrey D. Ullman. Second Edition.

CSE 422 COMPILER CONSTRUCTION LAB
3 Hours/Week, 1.5 Credits

How to use scanner and parser generator tools (e.g., Flex, JFlex, CUP, Yacc, etc). For a given simple source language designing and implementing lexical analyzer, symbol tables, parser, intermediate code generator and code generator.

CSE 423 COMPUTER GRAPHICS
3 Hours/Week, 3.0 Credits

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

Books:

1. Computer Graphics: Principles and Practice, Folley, Van Damn, Feiner, Hughes,
2. Computer Graphics: A Programming Approach: Steven and Harrington.
3. OpenGL(r) 1.2 Programming Guide, Third Edition: The Official Guide to Learning OpenGL, Version 1.2: by Mason Woo, Jackie Neider, Tom David, Dave Shriner, OpenGL Architecture Review Board, Tom Davis, Dave Shreiner.
4. Graphics Programming in C: Roger T. Stevens.
5. Texture and Modeling: by David S. Ebert.

CSE 424 COMPUTER GRAPHICS LAB
3 Hours/Week, 1.5 Credits

Tool to use for lab: OpenGL

1. Line Drawing: Bresenhams
2. Region Filling: Scan Line Algorithm
3. Transformation: 2D and 3D translation, Rotation, Scaling
4. Clipping: Line and Polygon
5. Projection: Perspective and Parallel
6. Animation: Morphing

CSE 425 CYBER AND INTELLECTUAL PROPERTY LAW
3 Hours/Week, 3.0 Credits

Course Description: An in-depth examination of the law dealing with computers and the Internet. Topics will include such issues as US and international jurisdiction, computer security, intellectual property rights management, copyrights, patents law, electronic commerce, information privacy, freedom of expression, and cyber crime. Included are detailed analyses of significant legal case studies plus review of applicable federal and state legislation as applied to compliance of international standards.

CSE 400 THESIS/ PROJECT I
4 Hours/Week, 2.0 Credits

Thesis/ Project work based on all major courses.

CSE 402 THESIS/ PROJECT II
4 Hours/Week, 2.0 Credits

Thesis/ Project work based on all major courses. This course can be a continuation of CSE 400.

CSE 404 VIVA VOCE
3 Hours/Week, 1.5 Credit

Comprehensive viva based on all studied major courses.

CSE 431 DIGITAL SIGNAL PROCESSING
3 Hours/Week, 3.0 Credits

Discrete Signals and systems. Z transform. Fourier transform, FFT, DFT, Digital filter design technique, interpolation, Decimation.

CSE 432 DIGITAL SIGNAL PROCESSING LAB
3 Hours/Week, 1.5 Credits

Laboratory works based on theory classes.

OPTIONS :

CSE 433 DIGITAL IMAGE PROCESSING
3 Hours/Week, 3.0 Credits

Digital image fundamentals, perception, representation; image transforms: Fast Fourier Transform (FFT), Discrete Cosine Transform (DCT), Karhunen and Loeve Transform (KLT), Wavelet transform and sub-band decomposition; image enhancement and restoration techniques, image compression techniques, image compression standards: JPEG, MPEG, H.261, and H.263.

CSE 434 DIGITAL IMAGE PROCESSING LAB
3 Hours/Week, 1.5 Credits

Laboratory works based on CSE 433. Students investigate image processing algorithms in Matlab or C.

CSE 435: PATTERN RECOGNITION
3 Hours/Week, 3.0 Credits

Pattern Recognition: introduction, importance; Statistical and Neural Pattern Recognition: Bayesian classifier, Bayes decision theory, discriminant functions and decision surfaces; Bayesian classifier for normal distributions; Linear classifiers: discriminant functions and decision hyperplanes, Perceptron algorithm and its variants, Kesslerâ€™s construction; Nonlinear classifiers: two and three layer perceptrons, backpropagation algorithm and its variants; Template matching: optimal path searching techniques, dynamic programming methods, correlation based matching and 2D log search algorithm for image matching; Context dependent classification: Viterbi algorithm, channel equalization, observable and hidden Markov models, three problems of HMM and their application in speech recognition; Syntactic Pattern Recognition: introduction to Syntactic Pattern Recognition, grammar-based approach, parsing, graph-based approach; Unsupervised classification: basic concepts of clustering, proximity measures, categories of clustering algorithms, sequential clustering algorithms.

Books:

1. R.O.Duda, P.E.Hart and D.G.Stork, Pattern Classification, John Wiley, 2001
2. S.Theodoridis and K.Koutroumbas, Pattern Recognition, 4th Ed., Academic Press, 2009
3. C.M.Bishop, Pattern Recognition and Machine Learning, Springer, 2006

CSE 436: PATTERN RECOGNITION LAB
3 Hours/Week, 1.5 Credits

Laboratory works based on CSE 435.

CSE 437 FIBER OPTICS
3 Hours/Week, 3.0 Credits

Optical Fiber as wave-guide: Ray theory, Modes, SMF, MMF, Step Index and Graded Index Fiber, **Transmission Characteristic:** Attenuation, Dispersion, Polarization, **Fabrication:** Liquid phase, Vapor phase, Fiber Cables, **Connectors and Couplers:** Alignment and joint loss, Splices, GRIN rod lens, Connectors, Couplers **Optical Source:** LASER, semiconductor injection laser, laser characteristic, modulation **Optical Detectors:** Photodiode construction, characteristic, p-n, p-i-n, APD, **Direct Detection:** Noise, Eye diagram, Receiver design **Fiber Amplifier:** construction, characteristic, use **Digital Transmission System:** Point to point link, power budget, Noise **Advanced Systems and Techniques:** WDM, Photonic switching, All optical network.

CSE 438 FIBER OPTICS LAB
3 Hours/Week, 1.5 Credits

1. Study of optical fibers
2. Multimode behavior of a optical fiber
3. Measurement of Bend Loss
4. Study of an optical attenuator
5. L-I curve of a Laser
6. Construction of a power meter
7. Fiber optic Data Communication
8. BER plot of fiber optic system
9. Project on fiber optic system

CSE 439 ADVANCED DATA STRUCTURE AND ALGORITHM
3 Hours/Week, 3.0 Credits

Red-Black Tree, Binary Index Tree, Segment Tree, Range minimum query, lowest common ancestor, k-d Tree, Interval tree, R-tree.
Advanced Application of Dynamic Programming and Backtracking.
Advanced String Structure and algorithm: tree, suffix tree, suffix array, Aho-Corasic.
Computational Geometry: Line Sweeping algorithms, Binary Space Partition Trees and Painter’s algorithm (other advanced computational geometry).
Optimization of network flow: Dinic's algorithm, Hungarian algorithm, Min cost max flow, min cut, graph coloring.
Genetic algorithm and its different applications, Basic Game theory, Linear programming, Polynomials and Fast Fourier Transform, Encryption and Decryption.

CSE 440 ADVANCED DATA STRUCTURE AND ALGORITHM LAB
3 Hours/Week, 1.5 Credits

Red-Black Tree, K-d Tree, Suffix Tree, Suffix Array, Line Sweeping algorithms, Painter's algorithm, Hungarian algorithm, Dinic's algorithm, Min cost max flow and the selected problem assign by the corresponding instructor.

CSE 441 CLOUD COMPUTING
3 Hours/Week, 3.0 Credits.

Introduction to different types of computing: Edge computing, Grid computing, Distributed Computing, Cluster computing, Utility computing, Cloud computing. **Cloud computing architecture:** Architectural framework; Cloud deployment models; Virtualization in cloud computing; Parallelization in cloud computing; Green cloud. Cloud Bus; **Cloud service models**: Software as a Service (SaaS); Infrastructure as a Service (IaaS); Platform as a Service (PaaS). **Foundational elements of cloud computing**: Virtualization; Cloud computing operating System; Browser as a platform; Advanced web technologies (Web 2.0, AJAX and Mashup); Introduction to autonomic systems; Service Level Agreements(SLA); Security/Privacy; Cloud economics; Risks assessment; Current challenges facing cloud computing. **Case studies.**
Practical sessions: Creating Windows servers on the cloud; Creating Linux servers on the cloud; Deploying applications on the cloud; Major cloud solutions.

CSE 442 CLOUD COMPUTING LAB
3 Hours/Week, 1.5 Credits.

Laboratory works based on CSE 441.

CSE 443 ADVANCED DATABASE SYSTEM
3 Hours/Week , 3.0 Credits

Introduction : Object oriented Database, Data Model, Design, Languages; **Object Relational Database:** Complex data types, Querying with complex data types, Design; **Distributed Database:** Levels of distribution transparency, Translation of global queries to fragment queries, Optimization of access strategies, Management of distributed transactions, Concurrency control, reliability, Administration**; Parallel Database:** Different types of parallelism, Design of parallel database; **Multimedia Database Systems:** Basic concepts, Design, Optimization of access strategies, Management of Multimedia Database Systems, Reliability; **Database Wire-housing/Data mining:** Basic concepts and algorithms.

Book: *Oracle Advanced PL/SQL Programming with CD-ROM,* by Scott Urman.

CSE 444 ADVANCED DATABASE SYSTEM LAB
3 Hours/Week, 1.5 Credits

Laboratory works based on theory classes.

CSE 445 MOBILE AND WIRELESS COMMUNICATION
3 Hours/Week, 3.0 Credits.

Aspects of radio wave propagation for fixed and mobile communication systems, and cellular system design. Large-scale and small-scale propagation models, multipath fading, link-budget, interference and frequency reuse, multiple access schemes and system capacity. Trunking and grade of service, wireless network planning and operation. Architecture and operation of 2G cellular mobile systems, 2.5 G and 3G technologies. Special techniques/Diversity, Equalization, Interleaving, and Smart Antenna.

CSE 446 MOBILE AND WIRELESS COMMUNICATION LAB
3 Hours/Week, 1.5 Credits.

Laboratory works based on CSE 445.

CSE 447 VLSI DESIGN
3 Hours/Week, 3.0 Credits

VLSI design methodology: top-down design approach, technology trends. NMOS, CMOS inverters, pass transistor and pass gates: dc and transient characteristics. Brief overview of fabrication process: NMOS, CMOS, Bi-CMOS process. NMOS and CMOS layout, stick diagram and design rules. CMOS circuit characteristics and performance estimation: resistance and capacitance, rise and fall time, power estimation. Buffer circuit design. Introduction to Bi-CMOS circuits.

Complex CMOS gates. CMOS building block: multiplexer, barrel shifter, adder, counter, multipliers. Data Path and memory structures. Design style: FPGA and PLDs.
Introduction to HDL: basic digital design using VHDL.

CSE 448 VLSI DESIGN LAB
3 Hours/Week, 1.5 Credits

Laboratory works based on theory classes.

CSE 449 BIO-INFORMATICS
3 Hours/Week, 3.0 Credits

Cell concept: Structural organization of plant and animal cells, nucleus, cell membrane and cell wall. **Cell division:** Introducing chromosome, Mitosis, Meiosis and production of haploid/diploid cell. **Nucleic acids:** Structure and properties of different forms of DNA and RNA; DNA replication. **Proteins:** Structure and classification, Central dogma of molecular biology. **Genetic code:** A brief account. **Genetics:** Mendel's laws of inheritance, Organization of genetic material of prokaryotes and eukaryotes, C-Value paradox, repetitive DNA, structure of chromatin - euchromatin and heterochromatin, chromosome organization and banding patterns, structure of gene - intron, exon and their relationships, overlapping gene, regulatory sequence (*lac* operon), Molecular mechanism of general recombination, gene conversion, Evolution and types of mutation, molecular mechanisms of mutation, site-directed mutagenesis, transposons in mutation. **Introduction to Bioinformatics:** Definition and History of Bioinformatics, Human Genome Project, Internet and Bioinformatics, Applications of Bioinformatics **Sequence alignment:** Dynamic programming. Global *versus* local. Scoring matrices. The Blast family of programs. Significance of alignments, Aligning more than two sequences. Genomes alignment. Structure-based alignment. **Hidden Markov Models in Bioinformatics:** Definition and applications in Bioinformatics. Examples of the Viterbi, the Forward and the Backward algorithms. Parameter estimation for HMMs. **Trees:** The Phylogeny problem. Distance methods, parsimony, bootstrap. Stationary Markov processes. Rate matrices. Maximum likelihood. Felsenstein's post-order traversal. **Finding regulatory elements:** Finding regulatory elements in aligned and unaligned sequences. Gibbs sampling. **Introduction to microarray data analysis:** Steady state and time series microarray data. From microarray data to biological networks. Identifying regulatory elements using microarray data. **Pi calculus:** Description of biological networks; stochastic Pi calculus, Gillespie algorithm.

CSE 450 BIO-INFORMATICS LAB
3 Hours/Week, 1.5 Credits

Laboratory works based on CSE 449.

CSE 451 NEURAL NETWORKS and FUZZY SYSTEMS
3 Hours/Week, 3.0 Credits

Fundamentals of Neural Networks; Back propagation and related training algorithms; Hebbian learning; Cohonen-Grossberg learning; The BAM and the Hopfield Memory; Simulated Annealing; Different types of Neural Networks: Counter propagation, Probabilistic, Radial Basis Function, Generalized Regression, etc; Adaptive Resonance Theory; Dynamic Systems and neural Control; The Boltzmann Machine; Self-organizing Maps; Spatiotemporal Pattern Classification, The Neocognition; Practical Aspects of Neural Networks.
Basic Concepts of Fuzzy set theory; Fuzzy numbers; Aggregation operations of Fuzzy sets; Fuzzy Rules and Fuzzy Reasoning, Fuzzy Inference Systems, Regression and Optimization, Supervised Learning Neural Networks, Neuro-Fuzzy Modeling, ANFIS, Neuro-Fuzzy Control, ANFIS Applications.

CSE 452 NEURAL NETWORKS and FUZZY SYSTEMS LAB
3 Hours/Week, 1.5 Credits

Laboratory works based on CSE 451.

CSE 453 NATURAL LANGUAGE PROCESSING
3 Hours/Week, 3 Credits

Introduction; Word Modeling: Automata and Linguistics, Statistical Approaches and Part of Speech Tagging; Linguistics and Grammars; Parsing Algorithms; Parsing Algorithms and the Lexicon; Semantic; Feature Parsing; Tree Banks and Probabilistic Parsing; Machine Translation; Evolutionary Models of Language Learning and Origins.

CSE 454 NATURAL LANGUAGE PROCESSING LAB
3 Hours/Week, 1.5 Credits

Processing of words, Phrase structure parsing, Semantic Interpretation with Phrase Structure Grammars

Books:
Jurafsky, D. and Martin, J. H. *Speech and Language Processing*. Prentice Hall: 2000. ISBN: 0130950696

Manning, C. D. and H. Schütze: *Foundations of Statistical Natural Language Processing*. The MIT Press. 1999. ISBN 0-262-13360-1.
Barton, E., Berwick, R., and Ristad, E. *Computational Complexity and Natural Language*: The MIT Press. 1987. ISBN 0-26-02266-4.
Allen, J. *Natural Language Understanding*. The Benajmins/Cummings Publishing Company Inc. 1994. ISBN 0-8053-0334-0.
Brady, J., and Berwick, R. *Computational Models of Discourse*. The MIT Press, 1983. ISBN-0-262-02183-8.

CSE 455 MACHINE LEARING
3 Hours/Week, 3.0 Credits.

Introduction to Machine Learning Concepts: Concepts of ML. Some ML applications and examples. The main components of a ML system. Requirements to design a ML system. Induction Learning: Learning a concept and hypothesis. Generalization and overfitting. Induction and bias. Hypothesis evaluation. Entropy and information gain. Decision tree algorithm and its application. Statistical Learning: Linear Regression using LSE and estimate MSE. Classification: Linear/non-linear separation. Nearest neighbour classifier. kNN algorithm with its advantage and disadvantage. Bayesian Learning: Bayes theorem. MAP and ML hypothesis. Naïve Bayes classifier. Artificial Neural Networks: Biological neuron vs a single artificial neuron. Transfer functions. Learning in artificial neural networks (ANNs). Single perceptron unit and the delta rule. Single layer and multi–layer perceptrons. The backpropagation learning algorithm. Using MLP-BP as a classifier. Performance measures of MLP-BP algorithm. Strength and limitations of ANN. Genetic Algorithms: GA terminology. Encoding of chromosomes. Selection operator in GA. Crossover and mutation operators in GA. Applications of GA: evolving ANN and genetic programming. Advantages and disadvantage of GA. Unsupervised Learning: Introduction to clustering. Clustering approaches: exclusive clustering using K-means algorithm, agglomerative clustering using hierarchical algorithm, overlapping clustering: using fuzzy C-means algorithm. Cluster validity problem and its quality criteria: Davies-Bouldin index.

CSE 456 MACHINE LEARNING LAB
3 Hours/Week, 1.5 Credits.

ID3 Algorithm for Decission Tree
Regression using LSE and estimating MSE
kNN Algorithm as Nearest Neighbor Classifier
Apply NB Classifier for a Classification Task
Application of the MLP-BP ANN algorithm.
Aapplication of GA for solving a problem
Exclusive clustering: K-means algorithm
Agglomerative clustering: Hierarchical algorithm
Overlapping clustering: Fuzzy C-means algorithm

Books:
1. Machine Learning, Tom Mitchell, McGraw Hill, 1997.
2. Introduction to machine learning (2nd edition), Alpaydin, Ethem, MIT Press, 2010
3. An Introduction to Support Vector Machines and Other Kernel-based Learning Methods, Nello Cristianini and John Shawe-Taylor, Cambridge University Press

CSE 457 PARALLEL PROCESSING AND DISTRIBUTED COMPUTING SYSTEMS

Von Neumann Model, Need of Parallel Processing, Flynns Classifications. Shared Memory Models, Network Based Models, Simulations. Definitions of Parallel Algorithms. Measures of Complexities, Algorithms for non-numerical and numerical problems on various parallel models such as Finding Summation. Finding Minimum, Maximum, Sorting, Searching, Selection, Graph Theoretical Problems, Combinatorial Problems, Matrix Transpose, Matrix Multiplication. Solution of simultaneous Linear Equations etc.

Distributed object systems, Retrieving and caching of distributed information, Distributed data replication and sharing, Performance issues, Algorithms for deadlock detection, Concurrency control and synchronization in distributed system, Models for distributed computation, Networking facilities and resource control and management methods in network and distributed operating systems, Collaborative applications, Wide area network computing, Web based commerce, Agent systems and Market based computing.

CSE 458 PROCESSING AND DISTRIBUTED COMPUTING SYSTEMS
3 Hours/Week, 1.5 Credits

Laboratory works based on CSE 457.

CSE 459 CONTEMPORARY COURSE ON COMPUTER SCIENCE AND ENGINEERING
3 Hours/Week, 3.0 Credits

This course covers a contemporary title in Conputer science and Engineering decided by the department.

CSE 460 CONTEMPORARY COURSE ON COMPUTER SCIENCE AND ENGINEERING LAB
3 Hours/Week, 1.5 Credits

Laboratory works based on CSE 457.

Non Major Courses:

MAT 101 MATRICES, VECTOR ANALYSIS AND GEOMETRY
3 Hours/Week, 3.0 Credits

The Matrix The Matrix and Matrix Operations, Inner Product and Cross Product, Geometric Vectors, Orthogonal Vectors, Different types of matrices, algebraic operations on matrices, Adjoint and inverse of a matrix, Rank and elementary transformation of matrices, Normal and canonical form, Diagonalisation of matrices. Solution of linear equations, Vector spaces, Characteristics roots and vectors.

Vector Analysis

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 curl. Various formulae, Integral forms of gradient, Divergence theorem, Stoke's theorem, Green theorem and Gauss's theorem.

Co-Ordinate Geometry

Co-Ordinate Geometry of two dimensions, Change of axes, Transformation of co-ordinates, Pairs of straight line, General equation of second degree, Co-ordinate Geometry of three dimensions, System of co-ordinates, Distances of two points, Section formula, Projection, Direction cosines, equations of planes and lines.

ENG 101 BASIC ENGLISH LANGUAGE
3 Hours/Week, 3.0 Credits

Developing Writing, Reading, Listening, and Speaking Skills:

1. Problems with: (a) Main Verbs; (b) Tense; (c) Modals and Modal-related patterns; (d) Causatives; (e) Conditionals; (f) Subjunctives; (g) Infinitives; (h) Have + Participle; (i) Auxiliary Verbs; (j) Pronouns, Relative Pronouns, Nouns and Adjectives, Nouns functioning as Adjectives and other Parts of Speech; (k) Determiners; (l) Comparatives; (m) Prepositions and prepositional idioms; (n) Point of View for Syntactical Pattern; (o) Agreement of verbs; (p) Introductory verbal; Modifiers; (q) Sentences and Clauses; (r) Word Choice – Vocabulary – Antonym, Synonym, Homonym, Homograph, Homophone; (s) Wh. Questions; (t) Punctuations: Full stop, comma, colon, semi colon, apostrophe, capital letter, hyphen, quotation marks, titles etc.; (u) Proofreading;

2. One Reading Comprehension of 20 marks (6 questions carrying 2.5 marks each) **3.** One Paragraph

CHE 101 GENERAL CHEMISTRY
3 Hours/Week, 3.0 Credits

1. Atoms, molecules and ions: Atomic Theory, components of atoms.
2. Electronic Structure: The quantum theory, the atomic spectrum of hydrogen and the Bohr model, Quantum numbers, Energy levels and orbitals, Electronic configuration, Chemical bonding and molecular structure.
3. The periodic Table: Development of the periodic table, Electron arrangements and the periodic table, Summarized chemical properties of s-block, p-block, d-block elements.
4. Chemical formulas and equations: Types of formulas, Percent composition from formula, Formulas from experiment, Mass relations in reactions, Limiting reagent and theoretical yield. Concept of mole, Solution: different concentration units.
5. Acids and Bases: Theories and Modern definition of acids and bases, Dissociation constant, strength, pH, Buffer solution etc.
6. Introduction to Chemical Kinetics: Rate laws, rate constant, equilibrium constant, order of reaction etc.

7. Environmental Chemistry: A brief introduction on relation of chemistry in everyday life and environment; Environmental aspects of Energy—Traditional, Fossil fuel, Nuclear, Solar etc.
8. Food : Preservatives, Flavor/ Coloring materials; Dye, etc.
9. Introductory Electrochemistry: Electrochemical cell and concentration cell, Cell reaction and derivation of Nernst equation. Measurement of emf of a cell. factors affecting electrode potential, rates of electrode potential, different parameters determined by potential measurements, Different types of cells used in practical purpose, Some modern cells and their action, Rechargeable cells.
10. Modern Perspective of Chemistry: Memory materials, Electronic Industries e.g. LCD, pure Silicon for IC, Semiconductor, insulator, etching materials etc.

Books:
1. Haider, S. Z. Introduction to Modern Inorganic Chemistry.
2. Haque and Mollah, Physical Chemistry
3. Raymond Chang, General Chemistry

PHY 101 MECHANICS, WAVES, HEAT AND THERMODYNAMICS
3 Hours/Week, 3.0 Credits

Mechanics: Motion in two dimensions; projectile motion; Newton's laws of motion; conservation theorems (momentum and energy); collisions; circular motion; rotational dynamics of rigid bodies; central forces and gravitation; Kepler's laws. Waves: Simple harmonic motion; damped and forced vibrations; waves in elastic media; sound waves; Doppler effect; Fourier's theorem and its applications. Heat and thermodynamics: Principles of thermometry; measurement of high and low temperature; zeroeth law of thermodynamics, kinetic theory of ideal gas; first and second laws of thermodynamics; entropy; black body radiation. Wein's law and Planck's law.

MAT 103 CALCULUS
3 Hours/Week, 3.0 Credits

Differential calculus:
Limit, Continuity and differentiability, Differentiation of explicit and implicit function and parametric equations, Significance of derivatives, Differentials, Successive differentiation of various types of functions. Leibnitz's theorem. Rolle's theorem. Mean value theorems. Taylor's theorem in finite and infinite forms. Maclaurin's theorem in finite forms. Langrange's form of remainders. Caunchy's form of remainder. Expansion of functions by differentiation and integration. Partial differentiation, Euler's theorem, Tangent, Normal, Subtangent and subnormal in Cartesian and polar coordinates.
Integral calculus:
Definitions of integration, integration by method of substitution, Integration by part, Standard integrals, Integration by the methods of successive reduction, Definite integrals, Its properties and use in summing series, Wallis's formulae, Imptoper integrals, Beta function and Gamma functions, Area under a plane curve in catresian and polar co-ordinates, Area of the region enclosed by two curves in Cartesian and polar co-ordinates.

PHY 103 ELECTROMAGNETISM AND OPTICS
3 Hours/Week, 3.0 Credits

Electromagnetism: Different electrical units; Coulomb's law; electric field; Gauss's law and its applications; electric potential and potential energy; capacitance, dielectrics and Gauss's Law, three electric vectors, energy storage in an electric field. magnetic field and field strength; magnetic forces on a current; torque on a current loop; Hall effect; Ampere's Law; Biot-Savart Law and their applications. Faraday's Law of induction; Lenz's Law; time-varying magnetic field; inductance; energy in magnetic field. Maxwell's equations; EM energy; Poynting Vector; Scalar and vector potentials; the wave equations. Plane EM waves in non-conducting media; waves in conducting media; boundary conditions; reflection and refraction at boundaries of two non-conducting media; total internal reflections.
Optics: Nature and propagation of light, interference of light, Young's experiment, Newton's ring. Michelson Interferometer. Diffraction: Fraunhofer and Fresnel diffraction, diffraction grating. Polarisation of light, optical activity, polarimetry.

ECO 201 PRINCIPLES OF ECONOMICS
3 Hours/Week, 3.0 Credits

MICRO
1. Introduction: Definition and scope of economics; basic concepts and tools used in economics; economic problems - scarcity and resources.
2. Demand, Supply, and Market: Concept of demand, supply and equilibrium; determinants of demand and supply; shifting of demand and supply curves; application of demand and supply; elasticity of demand and supply.
3. Theory of Consumer Behaviour: Concepts of utility; paradox of value; law of diminishing marginal utility; indifference curve; budget constraint; consumer's equilibrium.
4. Theory of Firm: Production function; law of diminishing return; stages of production; law of variable proportion; short run and long run production and costs.
5. Market: Structure of markets; characteristics of different types of markets; perfect competition and monopoly - price and output determination, monopolistic competition.
MACRO
1. Introduction to Macroeconomics: Definition: macroeconomic performance: measuring national product & national income-GNP, NNP, NI; personal disposable income; national & real GNP; circular flow of Income, value added approach.
2. Determination of national income: Components of aggregate demand & planned spending; aggregate demand; equilibrium output/Income Multiplier model of income and spending.
3. Money & banking: Definition & functions of money, components of money supply and money demand, multiple deposit creation, commercial banks & the money stock; functions of central bank, open market operations; high-powered money.
4. Inflation and Unemployment: Types and causes of inflation, expected & unexpected inflation: cost of inflation: money supply & the price level: velocity & quantity equation, types and causes of unemployment, remedial measures, Phillips Curve.

MAT 201 NUMERICAL METHODS
3 Hours/Week, 3.0 credits

Numerical analysis: Errors in numerical calculations. Error: Definitions, sources, examples. Propagation of Error. A general error formula. Taylor series and reminders. **Root finding :** The bisection method and the iteration method, the method of false position. Newton-raphson method. Roots of polynomials. **Methods of approximation theory :** Polynomial interpolation: Lagrange form, divided formula for interpolation. **Solution of systems of Linear equations:** Gaussian elimination. The pivoting strategy, Iteration method solution of tridiagonal systems. LU decomposition, matrix inverse. **Numerical solution of ordinary differential equations:** Euler's method (including modified form), Rnge-Kutta method. **Numerical Integration :** Trapezoidal method. Simpson's method. Weddle's method; Eigen value problems for matrices, Use of computer to implement projects in numerical methods.

Books:
Numerical Methods for Engineers - Steven C. Chapra, Raymond P. Canale

BBA 201 COST & MANAGEMENT ACCOUNTING
3 Hours/Week, 3.0 Credits

Introduction: Cost accounting: Definition, Limitations of Financial Accounting, Importance, Objectives, Functions and Advantages of Cost Accounting, Financial Accounting VS. Cost Accounting VS. Managerial Accounting, Techniques and Methods of Cost Accounting, International Cost Accounting Systems. Managerial accounting: Definition , Evolution , Objectives , Scope , Importance , Functions , Techniques , Differences among Managerial Accounting , Cost Accounting and Financial Accounting , Management Accounting for Planning and Control .Cost Classification : Cost Concepts , Cost Terms , Cost Expenses and Losses , Cost Center ,Cost Unit , Classification of Costs , Cost Accounting Cycle, Cost Statement , The Flow of Costs in a Manufacturing Enterprise ,Reporting and Results of Operation. Materials : Indirect & Direct Material , Procurement of Materials , Purchase Control , Purchase Department , Purchase Quantity , Fixed Order , Economic Order Quantity , Stock-out Cost , Re-order Level , Purchase Order , Receipts and Inspection ,Classification and Codification of materials ,Stock Verification , ABC Method of Store Control , Pricing of materials Issued , LIFO, FIFO and Average Pricing , Inventory Control; Labor: Labor Cost Control, Time Recording Systems, Manual and Mechanical Methods, Time Booking, Necessary Documents Maintained for Labor Control, Methods of Remuneration; Treatment for Idle and Over Time. Overhead: Definition , Classifications of Overheads , Methods of Overhead Distribution , Distribution of Factory Overhead to Service Departments, Redistribution of Service Department Cost , Uses of Predetermined Overhead Rates , Treatment of Over and under absorbed Overhead ,Treatment of Administration Overhead , Selling and Distribution Overheads , Calculation of Machine Hour rate . Job Order Costing: Feature Advantages, Limitation, Accounting for Materials, Labor and Factory Overhead in Job Costing, Accounting for Jobs Completed and Products Sold, Spoilage, Defective Work and Scrap in job Costing System, The Job Cost Sheet, Job Order Costing in Service Companies, Nature and Uses of Batch Costing, Determination of Economic Batch Quantity. Contract Costing: Introduction, Procedures, Types of Contract, Retention Money, Profit or Loss on Incomplete Contract, Cost plus Contract Systems; Operation Costing: Nature, Procedures, Costing for Transport and Hospital; Cost Behavior : Analysis of Cost Behavior , Measurement of Cost Behavior , Methods of Methods of Measuring Cost Functions , Analysis of Mixed Costs , High and Low Point Method , Scatter graph Method , Least Squares Method , Use of Judgment in Cost Analysis ; Cost – Volume Profit Relationship : Profit Planning , Break Even Point , Break Even Chart , Changes in Underlying Factors , Profit Volume Graph , Income Tax effect on Break Even Point , Break Even Point in Decision Making , Risk and Profit Analysis , Limitations .

STA 201 BASIC STATISTICS AND PROBABILITY
3 Hours/Week, 3.0 Credits

Frequency distribution of data: Population and sample. Collection and representation of statistical data. Tabulation of data. Class intervals. Frequency distribution, discrete, continuous and cumulative distributions. Histograms and frequency polygons. Graphical representation of data. **Statistical measures:** Measures of central tendency - arithmetic mean, median, mode, geometric mean, weighted average, harmonic mean. Measures of dispersion - range, standard deviation, variance, coefficient of variation, moments, skewness, kurtosis. **Correlation theory:** Linear correlation. Measures of correlation and its significance. **Regression and curve fitting:** Linear and non-linear regression. Methods of least squares. Curve fitting. **Probability:** Definition of probability and related concepts. Laws of probability. Discrete and continuous random variables. Mathematical expectations. Conditional probability. **Probability distributions:** Binomial, poisson and normal distributions and their properties. **Stochastic process.** Markov chain (discrete and continuous). Queuing theory - Birth death process in queuing. Examples from computer science. Queuing models. (Elementary concepts).

MAT 203 COMPLEX VARIABLES, LAPLACE TRANSFORM AND FOURIER SERIES
3 Hours/Week, 3.0 Credits

Complex Variable : Complex number system, general functions of a complex variable limits and continuity of a function of complex variable and related theorems. Complex differential and the Cauchy, Riemann equations. Mapping by elementary functions. Line integral of a complex function. Cauchy's integral formula. Kiouville's theorem. Taylor's and Laurent's theorem. Singular points. Residue. Cauchy's residue theorem. Evaluation of residues. Contour integration. Conformal mapping.
Laplace Transform: Definition. Laplace transforms of some elementary functions. Sufficient conditions for existence of laplace transform. Inverse Laplace transforms. Laplace transforms of derivatives. The unit step function. Periodic function. Some special theorems on Laplace transforms. Partial fraction. Solutions of differential equations by Laplace transform. Evaluation of improper integrals
Fourier series: Real and complex form. Finite transformation. Fourier integral. Fourier transforms.

GED 101 BANGLADESH STUDIES
3 Hours/Week, 3.0 Credits

Fundamental concepts: state, power, sovereignty, law, liberty government, institution, nationalism, constitution, democracy, dictatorship, unity and federal government, society and politics, war of liberation, nature of leadership, political process, constitutional framework of public administration, public service commission, ministry, secretariat, bureaucracy and local government.

Economy of Bangladesh: Socio-economic indicators of Bangladesh-GDP, Savings and Investment-Prices, wages and employment-agriculture-industry-power & Energy-transport & Communication-Human Resource Development-Poverty
Alleviation-Population-economic planning

Books:
1. Banglapedia
2. Economic Review of Bangladesh

List of Examiners:
All the teacher of relevant subjects of all the private and public universities