

COURSE CODE	COURSE TITLE	CREDIT
EEE11P6	Electricity, Magnetism and Electrical Circuit Lab	0.75

Experiment	Topics
01	Determine the value of an unknown resistance and to verify the laws of series and parallel resistances by using a Wheatstone bridge principle.
02	Determine the electrochemical equivalent of copper voltmeter.
03	Verification of Thevenin's Theorem.
04	Verification of Superposition Theorem.
05	Study of Signal generator and Oscilloscope.
06	Phase shift measurement of R-C circuit.
07	Phase power measurement by two Watt-meter method.
08	Determine the ratio of the horizontal component of the earth's magnetic field and the magnetic moment by employing a magnetometer.
09	Resistance measurement with color coding.

COURSE CODE	COURSE TITLE	CREDIT
CSE1127	Computer Fundamentals	2.0

Introduction to Computer System: Characteristics of Computer, Generation of Computer, Classification of Computer, Architecture of Computer System.

Number System: Commonly Used Number System, Decimal, Binary, Octal, Hexadecimal, Converting from One number system to another.

Binary Arithmetic: Binary addition, Binary subtraction, Binary multiplication, Binary Division, Representation of Characters - BCD - EBCDIC- ASCII, Representation of Integers in Computer, 1's Complement Representation, 2's Complement Representation, The r's and (r-1)'s Complement Representation of Real Number in Computer System.

Input Output Devices: Offline and Online Input Devices, Keyboard devices, Point and Draw devices, Data Scanning devices, Digitizer, Electronic cards based Devices, Speech Recognition Devices, Vision-based Devices, Monitor, Printer, Plotters, Screen Image Projector, Voice Response Systems.

Storage Devices: Primary Memory - Different Types of RAM, ROM, Cache Memory, Secondary Storage Devices - Magnetic Tape, Magnetic Disk, Floppy Disk, Hard Disk, CD/DVD ROM.

Processor: Internal Structure of Processor, Different Types of Processor, Processor Speed, and Concept of Instruction Set.

Algorithms and Flowcharts: Algorithms and its Characteristics, Flowchart, Different symbols used in Flowcharts, Advantages and Disadvantages of Flowcharts.

Computer Language: machine Language, High-Level Language, Assembly Language.

Software: Types of Software, Relationship between Hardware and Software, Different Ways of Acquiring Software, Steps to Develop Software, Firmware, Middleware.

Operating System: Types of Operating Systems, Single user - Multi-user, Multi-tasking, Multi-programming, Multi-processing, Time sharing, Real-Time Operating Systems.

Data Communication and Computer Networks: Basic elements of communication system, Data Transmission Techniques, Types of Computer Networks, Communication Protocols, Internetworking Tools, Characteristics of Distributed Data Processing.

Internet: Evolution and Basic services on the Internet, World Wide Web, Browsers, Uses of the Internet.

Books Recommended:

- (i) Norton, P. (2006). Peter Norton's Introduction to Computers (6th ed.). New York: Glencoe/McGraw-Hill.
- (ii) Sinha, P. (2010). Computer fundamentals (4th ed.). New Delhi: BPB Publications.
- (iii) Rahman, M., & Hossain, M. (n.d.). Computer Fundamentals. Systech Publications, Dhaka: 2002.

COURSE CODE	COURSE TITLE	CREDIT
CSE11P8	Computer Fundamentals Lab	0.75

Experiment	Topics
01	Creating, opening, closing, saving and editing a word Document.
02	[MS-WORD] Insert header and footer in the document.
03	[MS-WORD] Create a link between two files using Hyperlink.
04	[MS-WORD] Create a mail - merge and add data of 5 recipients.
05	[MS-WORD] Protect a document.
06	[MS-WORD] Implement macro.

07	[MS-POWERPOINT] Create duplicate slides in PowerPoint. Give an example.
08	[MS-POWERPOINT] Make a master slide.
09	[MS-POWERPOINT] Design a chart of population.
10	[MS-POWERPOINT] Insert Animation.
11	[MS-POWERPOINT] Insert a background in PowerPoint.
12	[MS-EXCEL] How you can filter your data.
13	[MS-EXCEL] Sort data in ascending and descending order.
14	[MS-EXCEL] To show the use of goal seeks.
15	[MS-EXCEL] To show the use of scenarios.
16	[MS-EXCEL] Perform any 5 Date and Time functions.
17	[MS-EXCEL] Perform any 5 Math & Trig functions.
18	[MS-ACCESS] With the help of Wizard create table having 5 elements.
19	[MS-ACCESS] Create a query in design view.
20	[MS-ACCESS] Make an admission form using design view in MS-Access.
21	[MS-ACCESS] Create a relationship b/w two tables.

First Year Second Semester

COURSE CODE	COURSE TITLE	CREDIT
MAT1231	Linear Algebra and Differential Equations	3.0

First-Order ODEs: Classification, existence and uniqueness; Slope fields; Separable and Linear 1st order; Exact equations and equations and other methods to and analytic solutions.

Mathematical Models and Numerical Methods: Population modeling; Equilibrium solutions and their stability; Models from physics.

Linear Systems and Matrices: Matrices and Gaussian elimination; Row operations; inverses of matrices and determinants.

Vector Spaces: Vector spaces and subspaces; Linear independence, bases and dimension; Row and column spaces for matrices.

Higher-Order Linear ODEs: Second order linear equations; General solution of linear equations; Equations with constant coefficients; Mechanical vibrations.

Eigen values and Eigenvectors: Eigen values and eigenvectors; Diagonalizing matrices

Homogeneous Linear Systems of ODEs: First order systems; Eigen value methods for linear systems; Mechanical applications.

Inhomogeneous Linear Systems of ODEs: Matrix exponentials; Inhomogeneous linear systems.

Nonlinear Systems: Phase plane; nonlinear applications.

Book References:

- (i) Edwards, C., & Calvis, D. (2010). Differential equations and linear algebra (3rd ed.). Upper Saddle River, NJ: Pearson Education.
- (ii) Zill, D., & Wright, W. (2013). Differential equations: With boundary-value problems (8th ed.). Boston, MA: Brooks/Cole, Cengage Learning.
- (iii) Boyce, W., & DiPrima, R. (2009). Elementary differential equations and boundary value problems (9th ed.). Hoboken, NJ: Wiley.
- (iv) Anton, H., & Rorres, C. (2011). Elementary Linear Algebra: With Supplemental Applications (10th ed.). New York: Wiley.
- (v) Lipschutz, S., & Lipson, M. (2013). Schaum's outlines linear algebra (5th ed.). S.I.: McGraw-Hill Education.

COURSE CODE	COURSE TITLE	CREDIT
HUM1222	Bangladesh Studies	2.0

Sources of History: Brief geo-political and socio-economic history of Ancient Bengal. The nature of origin, and development of Bengal Civilization.

Liberation War of Bangladesh: The socio-political and economic context of the Liberation War of Bangladesh and the background of the emergence of Bangladesh as an Independent Country.

The major socio-Economic and Cultural Features of Bangladesh

Agricultural Development: Agricultural Development and the Contribution of the agricultural sector to the national economy and Society of Bangladesh; An Overview of agricultural policies of Bangladesh.

The process of Industrialization: the evolution of industrial growth in Bangladesh: sector-wise development of industries; the role of private and public sectors in industrial development; an overview of industrial policies of Bangladesh.

Development of Public and Private sector in Bangladesh: The contribution of the private sector in the economy of Bangladesh; An Overview of Private sector development policy in Bangladesh; The opportunities and Challenges of Private sector development; The role of Foreign Investors and Development Partners(FIDP) in private sector development.

The Political and Government system: The form of Government; Bureaucracy as a system of administration; the role of political parties in sustaining modern democracy.

Books Recommended:

- (i) Sirajul Islam - History of Bangladesh 1704-1971, Asiatic Society of Bangladesh.
- (ii) Khan A.R. & M. Hassain -Development Strategy for Bangladesh.

COURSE CODE	COURSE TITLE	CREDIT
EEE1233	Electronic Device and Circuits	3.0

Semiconductor Devices: PN-Junction Diode- Drift and Diffusion Current, Diode: biasing, construction and V-I curve analysis, Zener Diode-Zener Regulator-BJT VI, Characteristics-CE Configuration-Current Equation h-Parameter Model. Current Equation- Transconductance MOSFET-Types DMOS, EMOS – V-I Characteristics-Moll Current Equation.

Rectifiers and Transistors: Half and full wave rectifiers: construction and application BJT, UTJ, JFET: construction, application and analysis, the concept of negative resistance, JFET-V-I Characteristics-

Amplifiers and Oscillators: Filter-Capacitance Input Filter-Choke Input Filter – CE Amplification with and without feedback – Analysis and Frequency Response – CS MOSFET Amplifier – Analysis

Operation Amplifier: Introduction of an Inverting Amplifier, Non-Inverting Amplifier, Basic Application of Operation Amplifier: Subtractor, Summing Amplifier, Analog to Digital Converter, Digital to Analog Converter, Low Pass Filter, First Order Low Pass Filter, First Order High Pass Filter, Integrator, Differentiator.

Books Recommended:

- (i) Bell, D., & Bell, D. (2008). Fundamentals of electronic devices and circuits (5th ed.). Don Mills, Ont.: Oxford University Press.
- (ii) Electrical Technology, Vol. 1: Basic Electronics, B.L. Theraja and A.K. Theraja, 2012
- (iii) Paynter, R. (2006). Introductory electronic devices and circuits: Electron flow version (7th ed.). Upper Saddle River, NJ: Pearson Prentice Hall.
- (iv) Boylestad, R., & Nashelsky, L. (2013). Electronic devices and circuit theory (11th ed.). Upper Saddle River, N.J.: Pearson Prentice Hall.

COURSE CODE	COURSE TITLE	CREDIT
EEE12P4	Electronic Device and Circuits Lab	1.5

Experiments	Topics
1	P-N Junction Diode Characteristics
2	Zener Diode Characteristics and Zener Diode as a Voltage Regulator
3	Transistor Common-Base Configuration Characteristics
4	Transistor Common-Emitter Configuration Characteristics
5	Half-Wave Rectifier With and Without Filter
6	Full-Wave Rectifier With And Without Filter
7	FET Characteristics
8	h-Parameters of CE Configuration
9	Frequency Response of CE Amplifier
10	Frequency Response of CC Amplifier
11	Frequency Response of Common Source FET Amplifier
12	Silicon-Controlled Rectifier (SCR) Characteristics
13	UJT Characteristics

COURSE CODE	COURSE TITLE	CREDIT
CSE1235	Digital Logic Design	3.0

Boolean Algebra and Logic Gates: Review of Number Systems – Arithmetic Operations – Binary Codes – Boolean Algebra and Theorems – Boolean Functions – Simplification of Boolean Functions using Karnaugh Map and Tabulation Methods – Logic Gates – NAND and NOR Implementations.

Combinational Logic: Combinational Circuits – Analysis and Design Procedures – Circuits for Arithmetic Operations, Code Conversion – Decoders and Encoders – Multiplexers and Demultiplexers – Introduction to HDL – HDL Models of Combinational Circuits.

Synchronous Sequential Logic: Sequential Circuits – Latches and Flip Flops – Analysis and Design Procedures – State Reduction and State Assignment – Shift Registers – Counters – HDL for Sequential Logic Circuits.

Asynchronous Sequential Logic: Analysis and Design of Asynchronous Sequential Circuits – Reduction of State and Flow Tables – Race-free State Assignment – Hazards.

Memory and Programmable Logic: RAM and ROM – Memory Decoding – Error Detection and Correction – Programmable Logic Array – Programmable Array Logic – Sequential Programmable Devices – Application Specific Integrated Circuits.

Books Recommended:

- (i) Mano, M., & Ciletti, M. (2013). Digital design: With a introduction to the verilog hdl (5th ed.). Upper Saddle River, NJ: Pearson Prentice Hall.
- (ii) Wakerly, J. (2006). Digital design: Principles and practices (4th ed.). Upper Saddle River, N.J.: Pearson/Prentice Hall.
- (iii) Roth, C., & Kinney, L. (2014). Fundamentals of logic design (7th ed.). Stamford, CT: Cengage Learning.
- (iv) Givone, D. (2003). Digital principles and design (1. ed., internat. ed.). Boston, Mass. [u.a.: McGraw-Hill.
- (v) Kharate, G. (2012). Digital electronics. New Delhi: Oxford University Press.

COURSE CODE	COURSE TITLE	CREDIT
CSE12P6	Digital Logic Design Lab	1.5

Experiments	Topics
01	Implementation of Basic Logic Gates : AND, OR, NOT
02	Implementation of Logic Gates : NOR, NAND, X-OR, X-NOR

03	Verification of De Morgan's theorem and Logic circuits
04	Implement Half Adder & Full Adder Circuit
05	Implement of BCD adder circuits,
06	Test & Verification of S – R, J – K, T, D Flip-Flop circuit
07	Implementation of Asynchronous Up & Down counter
08	Implementation of Synchronous Up & Down counter
09	Design and Implementation of BCD counter.
10	Test of IC of Encoder & Decoder
11	Test of IC of Multiplexer and De-multiplexer
12	Operation of seven segment display & Design of Digital Lock
13	Conversion of A/D and D/A

COURSE CODE	COURSE TITLE	CREDIT
CSE1237	Structured Programming Language	3.0

Introduction to Problem Solving: Flow charts, Tracing flow charts, Problem solving methods, Need for computer Languages, Sample Programs written in C

C Language preliminaries: C character set, Identifiers and keywords, Data types, Declarations, Expressions, statements and symbolic constants

Input-Output: getchar, putchar, scanf, printf, gets, puts, functions.

Pre-processor commands: #include, #define, #ifdef

Operators and expressions: Arithmetic, unary, logical, bit-wise, assignment and conditional operators

Control statements: While, do-while, for statements, nested loops, if else, switch, break, Continue, and goto statements, comma operators

Storage types: Automatic, external, register and static variables.

Functions: Defining and accessing, passing arguments, Function prototypes, Recursion, Library functions, Static functions

Arrays: Defining and processing, Passing arrays to a function, Multi dimensional arrays.

Strings: Defining and operations on strings.

Pointers: Declarations, Passing pointers to a function, Operations on pointers, Pointer Arithmetic, Pointers and arrays, Arrays of pointers, Function pointers.

Structures: Defining and processing, Passing to a function, Unions, typedef, array of structure, and pointer to structure

File structures: Definitions, concept of record, file operations: Storing, creating, retrieving, updating Sequential, relative, indexed and random access mode, Files with binary mode(Low level), performance of Sequential Files, Direct mapping techniques: Absolute, relative and indexed sequential files (ISAM) concept of index, levels of index, overflow of handling.

File Handling: File operation: creation, copy, delete, update, text file, binary file.

Books Recommended:

- (i) Venugopal, K., & Prasad, S. (2007). Mastering C. New Delhi: Tata McGraw-Hill Publishing Company Limited.
- (ii) Schildt, H. (2000). C, the complete reference (4th ed.). Berkeley: Osborne/McGraw-Hill.
- (iii) Kernighan, B., & Ritchie, D. (1988). The C programming language (2nd ed.). Englewood Cliffs, N.J.: Prentice Hall.
- (iv) Kanetkar, Y. (2008). Let us C (8th ed.). Hingham, Mass.: Infinity Science Press.
- (v) Schildt, H. (1997). Teach yourself C (3rd ed.). Berkeley: Osborne McGraw-Hill.

COURSE CODE	COURSE TITLE	CREDIT
CSE12P8	Structured Programming Language Lab	1.5

Experiments	Topics
1	Practice of writing different simple program like area of a circle, triangle, polygon, temperature conversion etc.
2	Implement Branching: The IF statement (break and continue statement), Branching: SWITCH statement, GOTO statement
3	Implementation of Looping: FOR statement (break and continue)
4	Implementation of Looping: WHILE and DO WHILE statement
5	Implementation of Library Functions
6	Implement Argument Passing and Value Receiving, Functions: Pass-by-value, Pass-by-reference
7	Value Receiving Functions: Command Line Parameter and, Arrays: Initialization, Access, Passing and Receiving
8	Arrays: 2D handling, Arrays:, String Handling , Structure: Initialization, Access, Passing and Receiving, Structure:, Union and Bit-fields
9	Implementation of Structures and Sorting and Searching program
10	Write program to handle Pointers.
11	Compiler and Linker, Segment and Memory Model, Video Adapter, Modes, Graphics Initialization, Graphics Functions
12	Write program for Text File Handling, Binary File Handling, Data File Management

Second Year First Semester

COURSE CODE	COURSE TITLE	CREDIT
MAT2131	Coordinate Geometry and Vector Analysis	3.0

Coordinate & Polar System:

Axis, Change of axis (Rotation) Distance, Straight line, circle

Polar Equation of conics (Two and Three Dimension):

Polar coordinate system, Distance between two points, Polar equation of a Straight line, Polar equation of a circle, Polar equation of a conic, Chords, Tangent and Normal to a conic, Chord of contact, Polar of a point.

Vector Algebra and its Applications to geometry (Plane and Straight Line):

Triple product, Reciprocal vectors, Product of four vectors. General equation of a Plane, Normal and Intercept forms, two sides of a plane, Length of perpendicular from a point to a plane, Angle between two planes, System of planes.

Direction Cosines and Direction ratios of a line, Projection on a straight line, Equation of a line, Symmetrical and unsymmetrical forms, Angle between a line and a plane, Coplanar lines, Lines of shortest distance, Length of perpendicular from a point to a line, Intersection of three planes, Transformation of coordinates.

Vector Differentiation:

Ordinary differentiation of vectors, Applications to mechanics, Velocity and Acceleration, Differential operator-Del, Gradient, Divergence and Curl,

Vector Integration: Line, Surface and volume integrals, Simple applications of Gauss divergence theorem, Green's theorem and Stokes theorem.

Books Recommended:

1.A text book on *coordinate geometry with vector analysis* ,A.F.M. Abdur Rahman, P.K. Bhattacharjee.

2.Murray R. Spiegel: Vector Analysis, Schaum's Outline Series, McGraw Hill.

3.N. Saran and S. N. Nigam: Introduction to vector analysis Pothishala Pvt. Ltd. Allahabad.

4.Shanti Narayan: A text book of vector calculus, S. Chand & co. New Delhi.

5.P. N. Pandey: Polar Coordinate Geometry, Sharda Academic Publishing House, Allahabad.

6.P. K. Jain and Khalil Ahmed: A textbook of Analytical Geometry, Wiley Eastern pub, New Age.

COURSE CODE	COURSE TITLE	CREDIT
CHE2122	Chemistry	2.0

Atomic structure, quantum numbers, electronic configuration, and periodic table. Properties and uses of noble gases. Different types of chemical bonds and their properties. Defects in solid; Semiconductors: Structures of Si, Ge, B, N, P,

In. Types of Semiconductor, Electronic and band theory. Chemical Bonding: Valence bond theory, molecular orbital theory, metallic bonding, hydrogen bonding, theory of resonance. Molecular structure of compounds. Selective organic reactions. Different types of solutions and their compositions. Phase rule, phase diagram of monocomponent system. Properties of dilute solutions. Thermochemistry, chemical kinetics, chemical equilibria. Ionization of water and pH concept. Electrical properties of solution.

COURSE CODE	COURSE TITLE	CREDIT
CSE2133	Discrete Mathematics	3.0

Logic and Proofs: Propositional Logic, Applications of Propositional Logic, Propositional Equivalences, Predicates and Quantifiers, Nested Quantifiers, Rules of Inference, Introduction to Proofs, Proof Methods and Strategy.

Sets and Functions: Sets, Set Operations, Functions, Sequences and Summations, Cardinality of Sets, Matrices.

Algorithms: Algorithms, the Growth of Functions, Complexity of Algorithms.

Number Theory and Cryptography: Divisibility and Modular Arithmetic, Integer Representations and Algorithms, Primes and Greatest Common Divisors, Solving Congruence, Applications of Congruence, Cryptography.

Induction and Recursion: Mathematical Induction, Strong Induction and Well-Ordering, Recursive Definitions and Structural Induction, Recursive Algorithms, Program Correctness.

Counting: The Basics of Counting, the Pigeonhole Principle, Permutations and Combinations, Binomial Coefficients and Identities, Generalized Permutations and Combinations, Generating Permutations and Combinations.

Graphs: Graphs and Graph Models, Graph Terminology and Special Types of Graphs, Representing Graphs and Graph Isomorphism, Connectivity, Euler and Hamilton Paths, Shortest-Path Problems, Planar Graphs, Graph Coloring.

Trees: Introduction to Trees, Applications of Trees, Tree Traversal, Spanning Trees, Minimum Spanning Trees.

Books Recommended:

- (i) Rosen, K. (2012). Discrete mathematics and its applications (7th ed.). New York: McGraw-Hill.
- (ii) Scheinerman, E. (2013). Mathematics: A discrete introduction. Boston, Mass.: Brooks/Cole.
- (iii) Goodaire, E., & Parmenter, M. (2006). Discrete mathematics with graph theory (3rd ed.). Upper Saddle River, N.J.: Pearson Prentice Hall.
- (iv) Roman, S. (1989). An introduction to discrete mathematics (2nd ed.). San Diego: Harcourt Brace Jovanovich.

- (v) Epp, S. (2011). Discrete mathematics with applications (4th ed.). Boston, MA: Brooks/Cole.
- (vi) Lipschutz, S., & Lipson, M. (1997). Schaum's outline of theory and problems of discrete mathematics (2nd ed.). New York: McGraw-Hill.

COURSE CODE	COURSE TITLE	CREDIT
CSE2134	Computer Architecture and Organizations	3.0

Fundamentals of a Computer System: Functional Units of a Digital Computer – Hardware – Software Interface – Translation from a High Level Language to the Hardware Language – Instruction Set Architecture – Styles and features – RISC and CISC Architectures – Performance Metrics – Amdahl's Law – Case Studies of ISA.

Basic Processing Unit: Components of the Processor – Datapath and Control – Execution of a Complete Instruction – Hardwired and Micro programmed Control – Instruction Level Parallelism – Basic Concepts of Pipelining – Pipelined Implementation of Data path and Control – Hazards – Structural, Data and Control Hazards – Exception handling.

Advanced Concepts in ILP and Current Trends: Exploitation of more ILP – Hardware and Software Approaches – Dynamic Scheduling – Speculation – Compiler Approaches – Multiple Issue Processors. – ILP and Thread Level Parallelism – Current Trends – Multicore Processors – Graphics and Computing GPUs.

Arithmetic for Computers: Addition and Subtraction – Fast Adders – Binary Multiplication – Binary Division – Floating Point Numbers – Representation, Arithmetic Operations.

Memory and I/O: Need for a hierarchical memory system – Types and characteristics of memories – Cache memories – Improving cache performance – Virtual memory – Memory management techniques – Associative memories.

Accessing I/O devices: Programmed Input/output – Interrupts – Direct Memory Access – Interface circuits – Need for Standard I/O Interfaces like PCI, SCSI, USB.

Books Recommended:

- (i) Patterson, D., & Hennessy, J. (2009). Computer organization and design: The hardware/software interface (4th ed.). Burlington, MA: Morgan Kaufmann.
- (ii) Hamacher, V. (2012). Computer organization and embedded systems (6th ed.). New York, NY: McGraw-Hill.
- (iii) Stallings, W. (2013). Computer organization and architecture: Designing for performance (9th ed.). Boston: Pearson.

- (iv) Hayes, J. (1988). Computer architecture and organization (2nd ed.). New York: McGraw-Hill.
- (v) Hennessy, J., & Patterson, D. (2007). Computer architecture a quantitative approach (4th ed.). Amsterdam: Elsevier/Morgan Kaufmann.

COURSE CODE	COURSE TITLE	CREDIT
CSE2135	Data Structure	3.0

Introduction: Elementary Data Structure, Data Structure Operations, Abstract Data Types(ADT), Algorithms Complexity and Time-Space Tradeoff.

Preliminaries: Mathematical Notation and Function, Algorithmic Notation, Control Structure, Complexity of Algorithm, Sub algorithm, Variables, Data Types.

String Processing: Storing Strings, Character Data Type, Strings as ADT, String Operations, Word/Text Processing, Pattern Matching Algorithms.

Arrays, Record and Pointers: Linear Arrays, Arrays as ADT, Representation of Linear Arrays in Memory, Traversing Linear Arrays, Inserting and Deleting, Bubble Sort, Linear Search, Binary Search, Multidimensional Arrays, Representation of Polynomials Using Arrays, Pointer Arrays, Dynamic Memory Management, Record Structure, Representation of Records in Memory, Matrices, Sparse Matrices.

Linked List: Representation of Linked List in Memory, Traversing a Linked List, Searching a Linked List, Memory Allocation, Garbage Collection, Insertion into a Linked List, Deletion from a Linked List, Header Linked Lists, Circularly Linked Lists, Two Way List, Josephus Problem and Its Solution, Buddy Systems.

Stacks, Queues and Recursion: Array Representation of Stacks, Linked Representation of Stacks, Stacks as ADT, Arithmetic Expressions- Polish Notation, Application of Stacks, Recursion, Tower of Hanoi, Recursion Procedures by Stacks, Queues, Linked Representation of Queues, Queues as ADT, Circular Queues, Deques, Priority Queues, Application of Queues.

Trees: Binary Trees, Representation of Binary Tree in Memory, Traversing Binary Tree, Traversal Algorithms Using Stacks, Header Nodes- Threads, Threaded Binary Trees, Binary Search Trees, Searching and Inserting in Binary Search Trees, Deleting in a Binary Search Trees, Balanced Binary Trees, AVL Search Trees, Insertion in an AVL Search Tree, Deletion in an AVL Search Tree, m-way Search Trees, Searching- Insertion- Deletion in an m-way Search Tree, B-Trees, Searching- Insertion- Deletion in a B-Tree, B+ Trees, Red-Black Trees, Heap, Heap sort, Path Length, Huffman's Algorithm, General Trees, Application of Trees.

Graphs and Their Applications: Graph Theory Terminology, Sequential Representation of Graph - Adjacent Matrix and Path Matrix, Warshall's Algorithm for Shortest Path, Linked Representation of Graph, Operations on Graph, Traversing a graph, Posets - Topological Sorting, Spanning Trees.

Sorting and Searching: Insertion Sort, Selection Sort, Merge Sort, Shell Sort, Radix Sort, Searching and Data Modification, Hashing.

Books Recommended:

- (i) Lipschutz, S. (2014). Data Structures (Revised First edition ed.). McGraw Hill Education.
- (ii) Horowitz, E. (1983). Fundamentals of data structures. New York: W H Freeman.
- (iii) Pai, G. (2008). Data structures and algorithms: Concepts, techniques and applications. New Delhi: Tata McGraw-Hill.

COURSE CODE	COURSE TITLE	CREDIT
CSE21P6	Data Structure Lab	1.5

Experiments	Topics
01	Array based implementation of stack and queue.
02	Linked list implementations and problems related to linked list such as insertion, deletion, inverting list, concatenation, etc.
03	Linked list based implementation of stack and queue
04	Evaluation of expressions
05	Binary tree traversals
06	Graph traversals
07	Merge sort
08	Quick sort
09	Binary search
10	Binary Heap
11	AVL tree implementation
12	Hash Tables

COURSE CODE	COURSE TITLE	CREDIT
CSE2137	Object Oriented Programming	3.0

Introduction: Introduction to Procedural Languages – Overview of Language space – Basic Concepts and Syntax – Types, variables, and constants – Scope and extent rules, blocks. – Expressions and Assignment – Program control (if, for, while...) –Intro to Java –Hello World.

Classes: Classes –Instances –Instance variables –declarations (public, private, final, static, etc) –Methods –calling methods –defining –static variables and methods –typical classes (data types, math obj, DB , containers, GUI.etc) – Constructors and Initialization .

Inheritance: Motivation and background –Inheritance in Java: extends – Polymorphism and RTTI. –Downcasting and upcasting –JavaDoc –examples – inner classes –anonymous classes.

Interfaces: Motivation –Interfaces in Java (Interface and Implements) – Interface design and implementation –Multiple inheritances.

OOP Design: Review –OOP as a programming style: manifestos – Encapsulation, Isolation, Abstraction –Separating Interface and Implementation – constructors –destructors (lack of in Java) – Accessors and Mutators (cloning issues on contained instances) –basic OOP design: choosing class and method – Interfaces vs. classes –Polymorphism and downcasting.

Exception Handling: Error handling strategies: return values vs exceptions – Basic Exception Handling –try/catch/finally/throw –Debugging.

I/O Programming: Devices and files –Streams –Programming in Java.

Event-Based Programming: Motivation, multiple input sources. –Basic notions, events, event loop, handlers/callbacks –Event models, Windows, X, Java –UI component events (vs. basic events) –Events in Java 2 (sources, listeners, handlers) –Getting source and data from event.

GUI Programming: Containers, layout, and components –Intro to Java Swing set. –HelloSwing, basic stuff (windowAdaptor) –buttons, text input, etc – containers and layout –list, table widgets.

Network Programming: Intro to IP networks –Sockets –Clients and listeners – Client/server Architectures –Networking Java –Web protocols(HTTP etc) –Web programming in Java –Serialization and Marshaling –RPC –Web sites as RPC's remote objects.

Books Recommended:

- (i) Horstmann, C., & Cornell, G. (2008). Core Java volume 1 and 2 ([Rev. & expanded 8th ed.]. Santa Clara, CA: Sun Microsystems Press.

- (ii) Gosling, J. (2014). The Java language specification Java SE 8 edition. Upper Saddle River, NJ: Addison-Wesley.
- (iii) Eckel, B. (2006). Thinking in Java (4th ed.). Upper Saddle River, NJ: Prentice Hall.
- (iv) Zakhour, S., & Kannan, S. (n.d.). The Java tutorial: A short course on the basics (Fifth ed.).
- (v) Deitel, P., & Deitel, H. (2015). Java, how to program – early objects (10. Ed., global ed.). Prentice Hall.
- (vi) Horton, I. (2011). Ivor Horton's beginning Java (Java 7 ed.). Indianapolis, IN: John Wiley & Sons.

COURSE CODE	COURSE TITLE	CREDIT
CSE21P8	Object Oriented Programming - I Lab	1.5

Experiments	Topics
01	Editing, compiling and executing a Java Program using jdk
02	Java classes and objects
03	Java Package With Simple Stack and Queue Class
04	I/O handling
05	Complex Number Manipulation
06	Date Class Similar To Java.Util Package
07	Inheritance, Polymorphism
08	Interfaces and Exception Handling, Packages
09	Creating and executing simple Applets
10	File handling
11	Multi-Threaded programming
12	Implementing Simple Client-Server (Connection oriented and Connectionless)
13	Java graphics programming

Second Year Second Semester

COURSE CODE	COURSE TITLE	CREDIT
ECO2221	Introduction to Economics	2.0

Nature and Scope of Economics: Definition and scopes of Economics; Micro-Economics and Macro- Economics; Positive vs normative Economics; Basic economic problems of every society; Production possibility frontier (PPF).

Basic Elements of Demand and Supply: Law of demand; demand schedule and demand curve; movement along the demand curve and shift of the demand curve; determinants of demand; law of supply; supply schedule and supply curve; determinants of supply; movement along the supply curve and shift of the supply curve; market equilibrium.

Elasticity: Basic idea of elasticity; price elasticity of demand and supply; various types of price elasticity of demand and supply with graphical exposition; cross and income elasticity of demand; measurement of elasticity.

Consumer Behavior: Utility; cardinal utility and ordinal utility; total utility and marginal utility; law of diminishing marginal utility; the idea of indifference curve; indifference map; properties of indifference curve; budget constraint; marginal rate of substitution (MRS) and consumer equilibrium.

Production and Costs: Concept of Production; factors of production and production function; input and output; returns to scale; average, marginal and total product; the concept of total, average and marginal cost; short run and long run cost; fixed and variable costs; the relationship between average and marginal cost; short and long-run average cost.

Theory of Firm: Definition of market; classification of market; characteristics of different markets.

National Income Accounting and Determination: GNP and GDP; real and nominal GNP and GDP; measurement of national income: product, income and expenditure methods; problems of measuring national income in the developing countries.

Books Recommended:

- (i) Samuelson, P., & Nordhaus, W. (2005). Economics (18th ed.). Boston: McGraw-Hill/Irwin.
- (ii) Roger A. Arnold, Economics, 9th Edition, Thomson Higher Education, 2009.
- (iii) Michael Parkin: *Microeconomics*, 5th edition, Addison-Wesley.
- (iv) N. Gregory Mankiw: *Principles of Microeconomics*, 4th edition, Cengage Learning.
- (v) Parkin, M. (2014). Economics (11th ed.). Boston: Pearson.
- (vi) Miller, R. (2014). Economics Today: The macro view. (17TH ed.). Upper Saddle River: Pearson.

COURSE CODE	COURSE TITLE	CREDIT
CSE2232	Microprocessors and Microcontrollers	3.0

The 8086 Microprocessor: Introduction to 8086, Microprocessor architecture, Addressing modes, Instruction set and assembler directives, Assembly language programming, Modular Programming, Linking and Relocation, Stacks, Procedures, Macros, Interrupts and interrupt service routines, Byte and String Manipulation.

8086 System Bus Structure: 8086 signals, Basic configurations, System bus timing, System design using 8086, IO programming, Introduction to Multiprogramming, System Bus Structure, Multiprocessor configurations, Coprocessor, Closely coupled and loosely Coupled configurations, Introduction to advanced processors.

I/O Interfacing: Memory Interfacing and I/O interfacing, Parallel communication interface, Serial communication interface, D/A and A/D Interface, Timer, Keyboard /display controller, Interrupt controller, DMA controller, Programming and applications Case studies: Traffic Light control, LED display , LCD display, Keyboard display interface and Alarm Controller.

Microcontroller: Architecture of 8051, Special Function Registers(SFRs), I/O Pins Ports and Circuits, Instruction set, Addressing modes, Assembly language programming.

Interfacing Microcontroller: Programming 8051 Timers, Serial Port Programming, Interrupts Programming, LCD & Keyboard Interfacing, ADC, DAC & Sensor Interfacing, External Memory Interface, Stepper Motor and Waveform generation.

Books Recommended:

- (i) Liu, Y., & Gibson, G. (1986). Microcomputer systems: The 8086/8088 family: Architecture, programming, and design (2nd ed.). Englewood Cliffs, N.J.: Prentice-Hall.
- (ii) Gaonkar, R. (2002). Microprocessor architecture, programming, and applications with the 8085 (5th ed.). Upper Saddle River, NJ: Prentice Hall
- (iii) Rafiquzzaman, M. (1995). Microprocessors and microcomputer-based system design (2nd ed.). Boca Raton, Fla.: CRC Press.
- (iv) Mazidi, M., & McKinlay, R. (2008). The 8051 microcontroller and embedded systems: Using Assembly and C (2nd ed.). Delhi.: Pearson/Prentice Hall .:
- (v) Ganguly, A., & Ganguly, A. (2012). Microprocessors and microcontrollers 8085, 8086 and 8051. Oxford: Alpha Science.

COURSE CODE	COURSE TITLE	CREDIT
CSE22P3	Microprocessors and Assembly Language Lab	0.75

Experiments	Topics
01	Simple programming exercises on 8085 (Like 8-bit multiplication, and division).
02	Code conversion, decimal arithmetic and Matrix operations.
03	Floating point operations, string manipulations, sorting and searching.
04	Simple programming with 8086 with a basic system calls for input/output (Arithmetic operations).
05	String manipulation - search, fixed and replace, copy operations, sorting and searching.
06	Shifting(Left Shift, Right Shift), Stack & Queue Implementation
07	File manipulations with system calls.
08	Interfacing with 8085/8086 – 8255 and 8253.
09	Interfacing with 8085/8086 – 8279, 8251, 8255
10	Microprocessor-based system development.
11	Application development using Microcontroller.

COURSE CODE	COURSE TITLE	CREDIT
CSE2234	Information System Analysis and Design	3.0

Introduction: Introduction to information systems, general design consideration of information systems.

Overview: System concepts and the information systems environment, information needs, the concepts of MIS, the system development life cycle, and the role of the systems analysis.

Systems Analysis: Systems planning and the initial investigation, information gathering, the tools of structured analysis, feasibility study, and cost-benefit analysis.

Systems Design: The process and stages of systems design, input/output and forms design, file organization and database design.

System Implementation: system testing and quality assurance, implementation and software maintenance, hardware/software selection, project scheduling and software, Security, disaster/recovery, and ethics in system development.

Case studies of various information systems such as Library management systems, inventory systems, voter identity management systems, payroll systems, etc.

Books Recommended:

- (i) Weinberg, G. (1988). Rethinking systems analysis & design. New York, NY: Dorset House Pub.
- (ii) Dennis, A., & Wixom, B. (2012). System analysis and design (5th ed.). Hoboken, NJ: John Wiley.
- (iii) Kendall, K., & Kendall, J. (2014). Systems analysis and design (9th ed.). Upper Saddle River, NJ: Pearson.
- (iv) Silver, G., & Silver, M. (1989). Systems analysis and design. Reading, Mass.: Addison-Wesley Pub.

COURSE CODE	COURSE TITLE	CREDIT
CSE22P5	Information System Analysis and Design Lab	0.75

Experiments	Topics
01	Discuss and Assign a Project Name for the overall study; Identify the problem & define its scope; Perform Analysis (Feasibility, Requirement), Proposed models for the development.
02	Define the functioning of the project which you want to achieve by the completion of a project; Perform analysis on the functions whether it is achievable or not.
03	Plan the overall sequence to perform all the tasks and time limit of each module; Finalize the development model; Prepare the Gantt chart for overall development.
04	Discuss the tool to draw different types of diagrams throughout the analysis & design; Create DFD, E-R diagram, Flowchart, Decision tree, and decision table for Project.
05	Plan for design, Structured Design, IPO chart, Input/output Form design, Navigation of forms and flow of the system; Describe UML diagrams, Draw all as per the system.
06	Prepare the SRS for the overall project.
07	Modeling your System using Object; Different testing techniques and how and which is applicable to system.
08	Quality Assurance and maintenance of the system. How to reduce the cost and time of maintenance.

COURSE CODE	COURSE TITLE	CREDIT
CSE2236	Computer Algorithms	3.0

Mathematical tools: Review of mathematical background, concepts of algorithm design, complexity, asymptotic notation, induction, and randomization, Fibonacci numbers, Euclidean gcd algorithms, Universal hashing.

Divide and conquer: Fast integer multiplication; recurrences; the master theorem; mergesort; randomized median and selection algorithms; quick sort; fast matrix multiplication.

Sorting: Lower bounds for comparison-based sorting; bin sort and radix sort.

Dynamic programming: Paradigm of SPs in DAGs; longest increasing subsequence; approximate string matching; integer and (0,1) knapsack problems; chain matrix multiplication; single-pair reliable SPs, all-pairs SPs; independent sets.

Graph search: Graph classes and representations; depth first search in undirected and directed graphs; topological search; strongly connected components. Breadth first search and layered DAGs.

Shortest Paths (SPs) in digraphs: Single-source SPs for nonnegative edge weights; priority queues and Dijkstra; SPs in DAGs; single-source SPs for general edge weights. Maximum adjacency search.

Greedy algorithms: Spanning trees and cuts, analysis of union-find and path compression; MST algorithms; the randomized algorithm for global minimum cuts; approximate set cover.

Network flows: Max flow min cut theorem and integrality; fast algorithms; disjoint (s,t)- dipaths; maximum bipartite matching & minimum vertex cover. Global minimum cuts.

NP-Completeness: Matching; Introduction to NP-Complete; Search/Decision; SAT; Independent_Set; 3VC; Exact Cover; Multi Set; Subset Sum & Partition; Hamiltonian Circuit.

Books Recommended:

- (i) Cormen, T. (2009). Introduction to algorithms (3rd ed.). Cambridge, Mass.: MIT Press.
- (ii) Dasgupta, S., & Papadimitriou, C. (2008). Algorithms. Boston: McGraw-Hill Higher Education.
- (iii) Baase, S., & Gelder, A. (2000). Computer algorithms: Introduction to design and analysis. (3rd ed.). Reading, Mass.: Addison-Wesley Longman.
- (iv) Horowitz, E., Sahni, S., & Rajasekaran, S. (2008). Fundamentals of Computer Algorithms (2nd ed.). Universities Press.

COURSE CODE	COURSE TITLE	CREDIT
CSE22P7	Computer Algorithms Lab	1.5

Experiments	Topics
01	Sorting Algorithms: To Analyze the time complexity of Insertion sort, Selection sort, Bubble sort, Bucket sort, and Heap sort.
02	Dynamic Programming: To Implement the Largest Common Subsequence, Optimal Binary Search Tree, and Matrix Chain Multiplication.
03	Divide and Conquer Technique: To Implement Strassen's matrix multiplication Algorithm, Quick sort, Merge sort.
04	Greedy Algorithms: To implement Knapsack Problem, Activity Selection Problem.
05	Graphs: To implement Dijkstra's Algorithm, Warshall's Algorithm, Bellman Ford's, Depth First Search Algorithm, Breadth First Search Algorithm.
06	String Matching Algorithms: To implement Naïve String Matching Algorithm, Rabin Karp String Matching Algorithm.
07	Spanning Trees: Prim's Algorithm, Kruskal's Algorithm.

COURSE CODE	COURSE TITLE	CREDIT
CSE2238	Database Management System	3.0

Introduction To Database Systems: Data - Database Applications - Evolution of DB & DBMS - Need for data management – Data models & Database Architecture - Professions in DBMS - Key issues and challenges in Database Systems

ER and Relational Models: ER Diagrams - Relational Model - ER to Relational Mapping - Constraints - Keys - Dependencies - Relational Algebra - Normalization - First, Second, Third & Fourth Normal Forms - BCNF – Join Dependencies

Data Definition and Querying: Basic DDL - Introduction to SQL - Data Constraints - Triggers - Database Security – Advanced SQL - Embedded & Dynamic SQL - Views

Transactions and Concurrency: Introduction to Transactions - Transaction Systems - ACID Properties - System & Media Recovery - Two-Phase Commit

Protocol - Recovery with SQL - Need for Concurrency Locking Protocols - Deadlocks & Managing Deadlocks - SQL Support for Concurrency

Advanced Topics in Databases: Indexing & Hashing Techniques - Query Processing & Optimization - Sorting & Joins – Database tuning - Introduction to Special Topics - Spatial & Temporal Databases - Data Mining & Warehousing - Data Visualization - Mobile Databases - OODB & XML Databases - Multimedia & Web Databases.

Books Recommended:

- (i) Silberschatz, A., & Korth, H. (2011). Database system concepts (6th ed.). New York: McGraw-Hill.
- (ii) Elmasri, R., & Navathe, S. (2011). Fundamentals of database systems (6th ed.). Boston: Addison-Wesley.
- (iii) Molina, H., & Ullman, J. (2009). Database systems: The complete book (2nd ed.). Upper Saddle River, N.J.: Pearson Prentice Hall.

COURSE CODE	COURSE TITLE	CREDIT
CSE22P9	Database Management System Lab	1.5

Experiments	Topics
01	Data Definition Commands.
02	Data Manipulation Commands.
03	DML Command to perform Nested and Join Queries.
04	Views – Creation and Manipulation.
05	Cursors and Triggers.
06	Procedural Extension Language.
07	Functions and Procedures.
08	Forms and Menu design using a Front End Tool.
09	Simple application development.
10	Report Generation.
11	Database connectivity techniques.
12	Design and implementation of a Database Application.

Third Year First Semester

COURSE CODE	COURSE TITLE	CREDIT
MAT3131	Statistics and Probability	3.0

Probability: Classical, relative frequency and axiomatic definitions of probability, addition rule and conditional probability, multiplication rule, total probability, Bayes' Theorem and independence.

Random Variables: Discrete, continuous and mixed random variables, probability mass, probability density and cumulative distribution functions, mathematical expectation, moments, probability and moment generating function, median and quantiles, Markov inequality, Chebyshev's inequality.

Special Distributions: Discrete uniform, binomial, geometric, negative binomial, hypergeometric, Poisson, continuous uniform, exponential, gamma, Weibull, Pareto, beta, normal, lognormal, inverse Gaussian, Cauchy, double exponential distributions, reliability and hazard rate, reliability of series and parallel systems.

Joint Distributions: Joint, marginal and conditional distributions, product moments, correlation and regression, independence of random variables, and bivariate normal distribution.

Transformations: functions of random vectors, distributions of order statistics, distributions of sums of random variables.

Sampling Distributions: The Central Limit Theorem, distributions of the sample mean and the sample variance for a normal population, Chi-Square, t and F distributions.

Descriptive Statistics: Graphical representation, measures of locations and variability.

Estimation: Unbiasedness, consistency, the method of moments and the method of maximum likelihood estimation, confidence intervals for parameters in one sample and two sample problems of normal populations, confidence intervals for proportions.

Testing of Hypotheses: Null and alternative hypotheses, the critical and acceptance regions, two types of error, power of the test, the most powerful test and Neyman-Pearson Fundamental Lemma, tests for one sample and two sample problems for normal populations, tests for proportions, Chi-square goodness of fit test and its applications.

Books Recommended:

- (i) Rohatgi, V., & Saleh, A. (2001). An introduction to probability and statistics (2nd ed.). New York: Wiley.

- (ii) Mendenhall, W., & Beaver, R. (2013). Introduction to probability and statistics (14th ed., International ed.). Pacific Grove, Calif.: Brooks/Cole ;.
- (iii) Milton, J., & Arnold, J. (2003). Introduction to probability and statistics: Principles and applications for engineering and the computing sciences (4th ed.). Boston: McGraw-Hill.
- (iv) Larson, H. (1982). Introduction to probability theory and statistical inference (3rd ed.). New York: Wiley.
- (v) Mosteller, F., & Rourke, R. (1970). Probability with statistical applications (2nd ed.). Reading, Mass: Addison-Wesley.

COURSE CODE	COURSE TITLE	CREDIT
CSE3122	Theory of Computation	2.0

Regular Languages: Finite Automata (FA) – Deterministic Finite Automata (DFA) – Non-deterministic Finite Automata (NFA) – Finite Automata with Epsilon transitions - Regular Expression – FA and Regular Expressions – Pumping lemma for Regular languages - Equivalence and minimization of Finite Automata.

Context-Free Languages: Context-Free Grammar (CFG) – Parse Trees – Ambiguity in grammars and languages – Equivalence of Parse trees and derivation - Normal forms for CFG - Definition of the Pushdown automata – Languages of a Pushdown Automata – Equivalence of Pushdown automata and CFG – Pumping lemma for CFL.

Closure Properties and Turing Machines: Closure properties of Regular Sets: Complement and Intersection – Closure properties of CFL: Union, Concatenation, Kleene Closure, Intersection and Complement – Turing Machines – Language of a Turing machine – Turing machine as a computing device - Various techniques for construction of TMs – Equivalence of one tape and multi-tape Turing machines.

Undecidability: A language that is not Recursively Enumerable (RE) – An undecidable problem that is RE – Undecidable problems about Turing Machine – Rice theorem for Recursive and Recursively enumerable languages – Post’s Correspondence Problem.

Recent Trends & Applications: Matrix grammar – Programmed grammar – Random context grammar – Regular Control grammar – Lindenmayer systems – A Glance on DNA computing and Membrane computing.

Books Recommended:

- (i) Hopcroft, J., & Motwani, R. (2007). Introduction to automata theory, languages, and computation (3rd ed.). Boston: Pearson/Addison Wesley.
- (ii) Lewis, H., & Papadimitriou, C. (1998). Elements of the theory of computation (2nd ed.). Upper Saddle River, N.J.: Prentice-Hall.
- (iii) Martin, J. (2011). Introduction to languages and the theory of computation (4th ed.). New York, NY: McGraw-Hill.

COURSE CODE	COURSE TITLE	CREDIT
CSE3133	Data and Telecommunications	3.0

Introduction to data communication: Components, data representation, data flow and basic model, data representation, Serial & Parallel transmission, Modes of data transmission, Encoding: Unipolar, Polar, Bipolar line & block codes, Data compression Frequency dependent codes, Run-length encoding, Relative encoding, LZ Compression Image and multimedia compression, Review of analogue & digital transmission methods, Nyquist Theorem.

Multiplexing: FDM, TDM, WDM, Synchronous & Statistical TDM, North American digital multiplexing hierarchy, European TDM, Spread spectrum: Frequency Hopping & Direct Sequence spread spectrum, Terminal handling & polling, Switched Communication Networks: Circuit, Message, Packet & Hybrid Switching, Soft switch Architecture with their comparative study, X.25, ISDN.

Physical Layer: Introduction, Interface, Standards, EIA-232-D, RJ-45, RJ-11, BNC connector & EIA-449 Digital Interface: Connection, specifications & configuration, X.21 Modem: Types, features, signal constellation, block schematic, limited distance, dial-up, baseband, line driver, Group Band and Null modems etc., ITU-T V-series modem standards Connecting Devices: Active and Passive Hubs, Repeaters, Bridges, Two & Three layer switches & Gateway. Study of various types of topology and their comparative study, introduction to queuing theory.

Transmission Media: Transmission line characteristics, distortions, Crosstalk, Guided Media: Twisted Pair, Baseband & Broadband Coaxial, Optical Fiber: Physics and velocity of propagation of light, Advantages & Disadvantages, Block diagram, Nodes And classification, Comparison, losses, light source and detectors, Construction, Unguided media: Electromagnetic polarization, Rays and waves front, electromagnetic spectrum and radiation, spherical wavefront and inverse square law, wave attenuation and absorption, optical properties of Radio waves, Terrestrial Propagation of electromagnetic waves, skip distance, free - space path loss, Radio waves, Microwave, Infrared & Satellite

Communication system. Telephone Network: Components, LATAs, signalling and Services, Digital Subscriber Line: ADSL, HDSL, SDSL, VDSL, Cable TV network for data transfer.

Transmission Errors: Content Error, flow integrity error, methods of error control, Error detection, Error correction, Bit error rate, Error detection methods: Parity checking, Checksum Error Detection, Cyclic Redundancy Check, Hamming code, Interleaved codes, Block Parity, Convolution code, Hardware Implementation, Checksum.

Telecommunication: Introduction to mobile communication, Cellular concepts, Wimax, 2G, 3G, 4G.

Books Recommended:

- (i) Forouzan, B. (2013). Data communications and networking (Fifth ed.). New York: McGraw-Hill.
- (ii) Tomasi, W. (2005). Introduction to data communications and networking. Upper Saddle River, N.J.: Pearson Prentice Hall.
- (iii) Gupta, P. (1998). Data communication. New Delhi: Prentice-Hall of India.
- (iv) Pahuja, S. (2005). The complete reference data communications and computer networks (2nd ed.). Delhi: Standard Distributors.
- (v) Tanenbaum, A., & Wetherall, D. (2011). Computer networks (5th ed.). Boston: Pearson Prentice Hall.

COURSE CODE	COURSE TITLE	CREDIT
CSE3134	Operating System	3.0

Operating Systems Overview: Computer System Overview - Basic Elements, Instruction Execution, Interrupts Memory Hierarchy, Cache Memory, Direct Memory Access, Multiprocessor and Multicore Organization. Operating system overview - objectives and functions, Evolution of Operating System - Computer System Organization - Operating System Structure and Operations - System Calls, System Programs, OS Generation and System Boot.

Process Management: Processes - Process Concept, Process Scheduling, Operations on Processes, Interprocess Communication; Threads - Overview, Multicore Programming, Multithreading Models; Windows 7 - Thread and SMP Management. Process Synchronization - Critical Section Problem, Mutex Locks, Semaphores, Monitors; CPU Scheduling and Deadlocks.

Storage Management: Main Memory - Contiguous Memory Allocation, Segmentation, Paging, 32 and 64-bit architecture Examples; Virtual Memory - Demand Paging, Page Replacement, Allocation, Thrashing; Allocating Kernel Memory, OS Examples.

I/O Systems: Mass Storage Structure - Overview, Disk Scheduling and Management; File System Storage - File Concepts, Directory and Disk Structure, Sharing and Protection; File System Implementation - File System Structure, Directory Structure, Allocation Methods, Free Space Management, I/O Systems.

Case Study: Linux System - Basic Concepts; System Administration - Requirements for Linux System Administrator, Setting up a LINUX Multifunction Server, Domain Name System, Setting up Local Network Services; Virtualization - Basic Concepts, Setting upXen, VMware on Linux Host and Adding Guest OS.

Books Recommended:

- (i) Silberschatz, A., & Galvin, P. (2009). Operating system concepts (8th ed.). Hoboken, NJ: J. Wiley & Sons.
- (ii) Stallings, W. (2014). Operating systems: Internals and design principles (Eighth ed.). Prentice Hall.
- (iii) Tanenbaum, A. (2014). Modern operating systems (4.th ed.). Boston: Pearson.
- (iv) Crowley, C. (1997). Operating systems: A design-oriented approach. Chicago: Irwin.
- (v) Dhamdhare, D. (2009). Operating systems: A concept-based approach. New York, N.Y.: McGraw-Hill.

COURSE CODE	COURSE TITLE	CREDIT
CSE31P5	Operating System Lab	1.5

Experiments	Topics
01	Basics of Linux commands.
02	Shell Programming.
03	Implement the following CPU scheduling algorithms <ol style="list-style-type: none"> a) Round Robin b) SJF c) FCFS d) Priority
04	Implement all file allocation strategies <ol style="list-style-type: none"> a) Sequential b) Indexed c) Linked
05	Implement Semaphores
06	Implement all File Organization Techniques <ol style="list-style-type: none"> a) Single level directory b) Two level c) Hierarchical

	d) DAG
07	Implement Bankers Algorithm for Dead Lock Avoidance
08	Implement an Algorithm for Dead Lock Detection
09	Implement all page replacement algorithms a) FIFO b) LRU c) LFU d) Optimal Algorithm
10	Implement Shared memory and IPC
11	Implement the Paging Technique of memory management.
12	Implement Threading & Synchronization Applications
13	Disk Scheduling Algorithms: First Come-First Serve (FCFS), Shortest Seek Time First (SSTF), Elevator (SCAN), Circular SCAN (C-SCAN), LOOK, C-LOOK.

COURSE CODE	COURSE TITLE	CREDIT
CSE3136	Advanced Database Management System	3.0

Working with large datasets with million records - use advanced queries (joins, unions), views, triggers, procedures, and aggregate functions. Storage - disk storage, basic file structure and hashing, Indexes, B-Trees and B+-Trees **(Review this session only, because it is an important issue)**; Query Optimization techniques. - Query Processing (translation of SQL Queries), cost estimation; Object Oriented Databases-Need for Complex Data Types, Persistence of Objects, Object Identity and pointers, Storage and access of persistent objects, Persistent C++ system, ODMG C++ object definition language.Database Security - access control, SQL injection attack, flow control, encryption, privacy issues and preservation

Database Backup and recovery - recovery concept, recovery based on immediate update, shadow paging, database backup, ARIES recovery algorithmDistributed Databases - distributed database architecture, query processing and optimization in distributed environment, transaction management system in in distributed environment, concurrency control in distributed environmentNo-SQL databases - introduction to no-SQL databases, mongodbConcurrency management - two-phase locking, timestamp ordering, multi-version concurrency control and so on.

Parallel Databases-Introduction, I/O parallelism, Interquery Parallelism, Intraquery parallelism, Interoperational parallelism.Database scaling - horizontal and vertical scaling.

Books Recommended:

- (i) Date, C. (2004). An introduction to database systems (8th ed.). Boston: Pearson/Addison Wesley.
- (ii) Dawes, C., & Thomas, B. (2002). OCA/OCF introduction to Oracle9i SQL study guide. San Francisco, Calif.: Sybex.
- (iii) Thomas, B. (2009). OCP: Oracle Database 11g Administrator Certified Professional Certification Kit. (1.st ed.). Indianapolis, Ind.: Wiley.
- (iv) Alapati, S., & Kuhn, D. (2011). Oracle database 11g performance tuning recipes a problem-solution approach. New York: Apress.

COURSE CODE	COURSE TITLE	CREDIT
CSE31P7	Advanced Database Management System Lab	1.5

Experiments	Topics
01	Data Definition Commands and Data Manipulation Commands.
02	DML Command to perform Nested and Join Queries.
03	Views, Triggers and procedures.
04	Database security - creating users, granting and revoking privileges to/from users, controlling user access using views.
05	Database security - demonstration of SQL injection attack and its prevention
06	Database backup and recovery
07	Database connectivity techniques.
08	Design and implementation of a Database Application.
09	Introduction to NoSQL database with MongoDB
10	More on NoSQL databases with MongoDB
11	Replication technique for scaling
12	Database partitioning methods