

**Unit I**

Complex Trigonometry: Revision of plane trigonometry – trigonometrical ratios, expressions for relation between allied angles and trigonometrical ratios, addition formulae for trigonometrical ratios and simple problems. Complex number and functions – definition, properties, De Moivre's theorem (without proof), roots of complex a number, expansions of  $\sin(nA)$ ,  $\cos(nA)$  in powers of  $\sin A$  and  $\cos A$ , addition formulae for any number of angles. Complex functions – real and imaginary parts of circular and hyperbolic functions, logarithmic function of a complex variable and simple problems.

**Unit II**

Differential Calculus: Limits, Continuity and derivative of a function (definition only), Rules of differentiation, derivatives of (i) standard functions, (ii) function of a function and (iii) parametric form functions. Introduction to Integration, methods of integration, definite integrals and simple problems.

**Unit III**

Set theory: Basic concepts of set theory, principles of inclusion and exclusion, mathematical induction. Counting principles – rules of sum and products, permutations and combinations, pigeon hole principle-simple problems.

Relations – properties, relation matrix and digraph of a relation, partition and covering, equivalence relation, compatibility relations, composition of binary relations, manipulation of relations, transitive closures, Warshall's algorithm –related problems.

**Unit IV**

Recurrence Relation and generating functions: Introduction, linear recurrence relation with constant coefficient (LLR)- backtrack method, homogeneous solutions, particular solutions, manipulation of numeric functions and generating functions. Solution of LLR by using generating function –problems.

Functions: Defining and introduction, various types of functions, composition of functions, inverse function, characteristic function of set, permutation function, hashing function, recursive functions-problems.

**Reference Books**

1. Higher Engineering mathematics (35<sup>th</sup> edition) by Dr. B.S Grewal, Khanna Publishers.
2. Elementary Engineering mathematics (6<sup>th</sup> edition) by Dr. B.S Grewal, Khanna publishers
3. Discrete Mathematical structure with Applications to computer science by tremblay and Manohar(McGraw-Hill publications).
4. Elements of discrete mathematics by C. L. Liu (tata Mcgraw-hill publications).

**Unit-1:**

**Fundamentals of accounting:** Meaning of the book keeping, Objectives and Benefits, Accounting concept and conventions, journal, ledger, trial balance, and subsidiary books.

**Sole trading accounts:** Preparation of trading accounts, profit and loss account and balance sheet, problems on balance sheets.

**Unit-2:**

**Ratio analysis:** Meaning uses, kinds of ratios a) Liquidity ratios b) profitability ratios c) turnover ratios Simple problems on ratio analysis.

**Fund Flow statement:** Meaning uses, limitations, preparation of Statement of changes in working capital Statement of fund flow operations Fund flow statement.

**costing:** Nature and importance of cost clarification and preparation of cost sheet.

**Unit-3:**

**Budget and Budgetary control:** Meaning of budget and budgeting, importance, limitations of budgetary control, Types of budget: Master budget and functional budget.

**Standard Costing:** Meaning of standard cost and standard costing uses, merits and demerits of, standard costing variance analysis, problems on material cost variance, material price variance, material usage (quantity) variance, material mix and yield variances.

**Unit-4:**

**Marginal Costing:** Meaning of marginal cost and marginal costing, basic concepts: contributions, P/V ratios, margin of safety, angle of incidence, problems on marginal costing, break – even analysis with charts.

**Capital Budgeting:** Meaning, kinds of capital budgeting (theory), problems on Payback period method, Accounting Rate of return method, Net present value (NPV) method, Internal rate of return method, Profitability index.

**Reference books:**

1. Management Accountancy: Sarkar.N.
2. Financial management: I.M.Pandey.
3. Accountancy: B.S.Raman
4. Management Accounting – Tools and techniques: N Vinayakam and Sinha
5. Principals of accounting, PHL: Levy and Samat

**Unit-1**

Overview of C- Importance of C, Basic structure of C Programs, Basic programming constructs-character set, tokens, Constants, Variables, and Data Types, Keywords and identifiers, symbolic constants

Operators and Expression – Arithmetic, relational, logical, increment and decrement, conditional, bitwise, Expression, precedence of operators, type conversion and casting, mathematical functions, Managing Input and Output Operations - Reading a character, writing a character, formatted input, formatted output

**Unit-II**

Decision Making and Branching – If statement – Different forms of if statement, , switch, break and continue, Looping statements in C – For, while and do while, nested loops, Structured data types in C – Array – One dimensional and two dimensional array, String, Structures and union

**Unit-III**

User-Defined Functions – Need for user-defined functions, multi-function program, general form of C function, Category of functions, Handling of non-integer functions, Nesting of functions, Recursion, Functions with arrays and Structures, The scope and lifetime of variables in functions.

**Unit-IV**

Pointers and File Handling - Understanding pointers. Accessing the address of a variable, Declaring and initializing pointers, Accessing a variable through its pointer. File Handling– Definition and need of file. Defining, Opening, and Closing a file. Input and output operations on files. Random access to files with example programs.

**References :**

1. C programming Language by Kernigham and Ritchie, 2nd Edition, PHI Publications
2. Programming in ANSI C 2nd Edition by E Balaguruswamy Published by Tata McGraw Hill.
3. Let Us C – Yashwant Kanetkar, 13th Edition, BPB publication
4. Problem Solving with C, M.T. Somashekara, PHI Learning, New Delhi, 2009

**Unit-I**

Introduction to Computers

History, Generations of Computers, Overview of the Computer system, Applications of computer, Classification of computers, Input and Output devices , The monitor - Printers - Sound systems - Types of storage devices - Magnetic storage devices, Optical Storage devices

Number Systems: Binary, Octal, Decimal and Hexadecimal, conversion from one base to another, complements, addition and subtraction of numbers using complements, representations of negative numbers, binary storage and registers, binary logic.

**Unit-2**

Boolean algebra and logic gates: Axioms and basic theorems, functions, canonical and standard forms, digital logic gates, Introduction to TTL, CMOS and ECL logic families. Simplification of Boolean functions: Map method – up to 4 variables functions, sum of products and product of sums simplifications. NAND, NOR, implementations, taking care of Don't care conditions

**Unit-3**

Combinational logics: Design procedure, adders, subtractors, code conversion, multilevel NAND and NOR circuits, EXOR and Equivalent functions.

Parallel adders, decimal adders, comparator, decoders, multiplexers, ROM and PLA.

**Unit-4**

Introduction to sequential logic: Flip flops, triggering, design of synchronous and asynchronous counters, registers, shift register, memory unit, RAM's.

Digital to analog conversion: Interfacing with analog world – basic blocks, design of simple DAC circuits, meaning of resolution, binary weighted resistor DAC, R2R DAC, Analog to digital conversion, general circuit, digital ramp ADC.

**References**

1. Peter Norton's 'Introduction to Computers', Second edition, TMH.
2. Moris Mano, "Computer System Architecture", PHI Publications, 2002.
3. V. Rajaraman : Computer Fundamentals (PHI).
4. Thomas C Bartee, Digital Computer Fundamentals, Tata McGraw Hill

## Unit-1

**Introduction** – applications of computer graphics, operations of computer graphics, graphics software packages. Graphical input – output devices- graphical input devices, graphical output devices Raster and random scan devices,

**Scan conversion** – scan conversion methods, polynomial method for line, polynomial method for circle, DDA algorithm for line, circle and ellipse, Bresenham's algorithm for line drawing and circle. Midpoint methods for line and circle .

## Unit-2

**Scan conversion for solids**- solid areas or polygons, inside-outside test – odd even method, winding number method. Solid area filling algorithms- boundary fill algorithm, scan line fill algorithm, scan line seed fill algorithm, ordered edge list algorithm.

**2D geometrical transformations** – basic 2d transformations- translation, rotation, scaling, homogeneous co-ordinate system – transformations in homogeneous notation, Other transformations – reflection about any arbitrary line, shearing, combined transformation- computational efficiency, visual reality, inverse of combines' transformations.

## Unit-3

**3D geometrical transformations**- basic 3D transformation- 3D translation, 3D scaling. 3D rotation, rotation about an arbitrary axis in space, other 3D transformations- 3D reflection, reflection about any arbitrary plane, 3D shearing.

**Projection** – introduction, parallel projection and perspective projections. Image formation inside a camera.

## Unit-4

**2D viewing and clipping**- windows and viewports, viewing transformation, clipping of lines in 2D- cohen-sutherland clipping algorithm, midpoint subdivision method, polygon clipping – Sutherland – hogman polygon clipping. **Curve design** – classical techniques for designing curves and object surfaces, modern curve representations.

## References

1. Computer Graphics, Donald Hearn, M. Pauline Baker, Prentice-Hall
2. Computer Graphics, Roy A. Plastock, Gordon Kalley, Schaum's Outlines, McGraw Hill
3. Computer Graphics : Principles and Practice in C, Andries Van Dam, F. Hughes John, James D. Foley, Steven K. Feiner, 2nd Edition, Pearson Education
4. Computer Graphics 2nd Edition (Paperback) by Steven Harrington, Tata McGraw Hill

**UNIT-1**

**Computer Arithmetic:** Floating point representation of numbers, arithmetic operations with normalization, consequences of normalized floating point representation of numbers, Errors in numbers

**Finding the roots of an equation:** Iterative method: Introduction, Beginning an iterative method, Bisection method, Newton Raphson method, Regula Falsi method, Secant Method. Comparison of Iterative methods, Order of Convergence of Newton Raphson Method and Secant Method.

**Unit-2**

**Ordinary differential equations:** Euler's method, Taylor series method, Range Kutta II and IV order methods.

**Numerical Integration:** Simpson's 1/3 and 3/8 rule, Trapezoidal rule.

**Unit-3**

**Solving simultaneous linear equations:** Introduction, Gauss Elimination method, pivoting, illconditioned equations, Gauss Jordan method, LU Decomposition method and Gauss-Seidel iterative method. Comparison of direct and iterative methods.

**Unit-4**

**Interpolation:** Introduction, Lagrange interpolation, Difference Tables- Newton-Gregory Forward and Backward interpolation, Truncation error in interpolation.

**Statistical methods:** Introduction, definitions, classifications, frequency distribution, mean-arithmetic mean for grouped and ungrouped data, continuous frequency distribution(step deviation method), Geometric mean for grouped and ungrouped data.

**References:**

1. Computer Oriented Numerical Methods by Rajaraman. V.
2. Fundamentals of Mathematical Statistics by Gupta and Kapoor (Sultan Chand).
3. Probability and Statistics for engineers and scientists by Ronald E. Walpole and Raymond H Mayers.
4. Mathematical Statistics by John Freund (Prentice Hall India Pvt. Ltd.)

## **Operational Research**

**3:1:0**

### **Unit I:**

Definition of the term Operation Research – Nature , Management Application , Modeling , Principles of modeling , features , Different Phases , scope , Advantages and Limitations of O.R. General method for solving O.R models and Role o O.R in decision making. Some important definitions – solutions to LPP, feasible solution, basic solutions, Basic feasible solution, Optimum basic feasible solution, unbounded solution. Assumptions in LPP, Limitations of LPP, Applications of LPP and advantages of LPP.

### **Unit-2**

Standard Linear Programming – Formulation of a Linear Programming Solving L.P.P. by Graphical Method Problem. And Simplex Method.

Artificial Variable Technique – two phase method and Big M method,

Duality – Meaning, definitions of primal problem , General rules for converting any primal problem into its dual . Characteristics of Dual problem, Advantages of Duality, Dual formulation procedure and Problems to obtain the dual of LPP. Fundamental Duality theorems, Primal and Dual correspondence.

### **Unit 3:**

Transportation Problems – Method of finding initial basic feasible solution to Transportation problem-North West Corner, Least Cost Method and Vogel’s Method.

Method of finding initial basic feasible solution to Assignment Problem using Hungarian Method.

### **Unit-4**

Sequencing Problems – Definitions, terminology and notations, Principle assumptions, Processing ‘n’ jobs through two machines

Travelling Salesman (Routing) Problems - Formulations of TSP as an assignment problem

### **Reference Books:**

1. “Operation Research”, by S.D.Sharma Kedarnath Ramnath Publishers 16th edition 2010.
2. Operation Research by J.K Sharma, 5<sup>th</sup> Edition, MacMillan Publishers, 2013
3. Operation Research, S.K. Kumar, First Edition, Khataria and Sons Publishers

**Unit-1**

System Concept: Definition, Characteristics, Elements of system, Physical and abstract system, open and closed system, man-made information systems. System Development Life Cycle: Various phases of system development, Considerations for system planning and control for system success.

System Planning: Base for planning a system, Dimensions of Planning. Initial Investigation: Determining users requirements and analysis, fact finding process and techniques.

Feasibility study: Determination of feasibility study, Technical, Operational & Economic Feasibilities, System performance constraints, and identification of system objectives, feasibility report.

**Unit-2**

Cost/Benefit Analysis: Data analysis, cost and benefit analysis of a new system. Categories determination and system proposal.

Tools of structured Analysis: Logical and Physical models, context, diagram, data dictionary, data diagram, form driven methodology, IPO and HIPO charts, Gantt charts, system model, pseudo codes, Flow charts- system flow chart, run flow charts etc., decision tree, decision tables, data validation,

**Unit-3**

Input/ Output and Form Design: Input and output form design methodologies, menu, screen design, layout consideration. Management standards – Systems analysis standards, Programming standards, Operating standards. Documentation standards – User Manual, system development manual, programming manual, programming specifications, operator manual. System testing & quality: System testing and quality assurance, steps in system implementation and software maintenance.

**Unit-4**

System security: Data Security, Disaster/ recovery and ethics in system development, threat and risk analysis. System audit. Organization of EDP: Introduction. Job Responsibilities & duties of EDP Personnel- EDP manager, System Analyst, Programmers, Operators etc. Essential features in EDP Organization. Selection of Data Processing Resources: purchase, lease, rent-advantages and disadvantages.

**References:**

1. Awad, Elias M: “System Analysis and Design” Second Edition. Galgotia Publication Pvt.Ltd.
2. System Analysis & Design by V K Jain, Dreamtech Press
3. Modern System Analysis & Design by A Hoffer, F George, S Valaciah Low Priced Edn. Pearson Education.
4. Information Technology & Computer Applications, by V.K.Kapoor, Sultan Chand & Sons, New Delhi.



## **Fundamentals of Data Structures**

**3:0:1**

### **Unit-1**

Introduction – Need for data structures, classification of data structures, Introduction to algorithm- Sequential, Selection and Iteration, Algorithmic notations, Concept and terminology for non-primitive Data structures

Arrays-Memory Representation of 1D and 2D, Operations on Arrays,

Stacks- Definitions and Concepts, Operations on stacks, Applications of stacks- Recursion, Infix to postfix, and Evaluating postfix expressions,

### **Unit-2**

Queues- Linear, Circular and Priority Queues, Operation on queues, applications

Linked list : Pointers and Linked Allocation, Linked linear lists, Operations on Linear lists

Circular linked lists- Memory Representation

Doubly linked linear lists- Memory Representation.

### **Unit-3**

Nonlinear Data Structures

Trees - Definition and concepts, Operations on Binary Trees, Storage Representations of Binary

Trees- Sequential and Linked, Tree Traversal,

Binary Search Tree- Creation and Traversal

### **Unit-4**

Sorting and searching

**Sorting-** Selection sort, Bubble Sort, Insertion Sort, Merge Sort, Quick Sort, Radix sort

**Searching-** Sequential and Binary searching

### **Reference Books:**

1. An Introduction to Data Structures with Applications 2<sup>nd</sup> edition - J.P.Trembly and Sorenson, McGraw Hill 2001.
2. Data structures using C , Aaron M Tenenbaum, Yedidyah Langsam, Pearson
3. Data Structures And Program Design In C, Robert L Cruse, Pearson
4. Systematic Approach to Data Structures Using C by Padma Reddy

## **System Software and Operating System**

**3:1:0**

## **Unit-1**

System software and machine architecture – Hypothetical Machine architecture, Assembler - Elements of assembly language, concepts of One pass and two pass assemblers. Loader and Linker - Loader and linker functions, General loading scheme, Macro processor - Basic macro processor functions

## **Unit-2**

Operating system : Introduction - Functions, types, Operating system services, System calls and system programs.

Process Management : Process Concept, process state diagram, process Control block , Process Scheduling- Multithreading Models, Threading Issues, Scheduling policies

## **Unit-3**

Process Synchronization, critical section problem, Bakery Algorithm, Semaphores-Meaning, Types of Semaphores, Synchronization problems- Bounded Buffer Problem, Readers-Writers problem and Dining Philosophers problem.

Deadlocks: Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance and recovery

## **Unit-4**

Memory Management: Memory management functions, Memory management techniques, Virtual memory management - Segmentation, Demand paging, File management – concepts, Directory structures, file allocation and access methods

## **Reference Books:**

1. D. M. Dhamdhere, “Systems Programming and Operating Systems”, Second Revised Edition, Tata McGraw-Hill, 1999.
2. John J. Donovan “Systems Programming”, Tata McGraw-Hill Edition, 1972.
3. Operating System Concepts – 5th edition by Abraham Silberschartz and Peter Galvin, McGraw Hill, 2000
4. Operating Systems : Internals and Design Principles, William Stallings, PHI

**Unit 1****Introduction**

Procedure-oriented programming, Concepts of Object-oriented programming, benefits of OOP, Applications of OOP, Structure of C++ program.

Tokens, Keywords, Identifiers and constants, Basic Data Types, User-defined data types, Derived data Types, Symbolic constants, Type compatibility, Declaration of variables, Dynamic initialization of variables, Reference variables, Operators in C++, Scope resolution operator, Member dereferencing operators, Memory management operators, Manipulators, Type cast operator, Expressions and their types, Special assignment expressions, Implicit conversions, Operator overloading, Operator precedence, Control structures.

**Unit-2****Functions**

The main function, Function prototyping, Call by Reference, Return by Reference, Inline functions, Default arguments, const arguments, Function overloading, Friend and Virtual functions.

**Classes and Objects**

Specifying a Class, Defining member functions, Making an Outside function Inline, Nesting of member functions, Private member functions, Arrays within a Class, Static data members, Static member functions, Arrays of Objects, Objects as function arguments, friendly functions, Returning Objects, const member functions, Pointers to members.

**Constructors and Destructors**

Constructors, Parameterized constructors, Multiple constructors in a class, Constructors with default arguments, Dynamic initialization of objects, Copy constructor, Dynamic constructor, Constructing Two-dimensional arrays, const Objects, Destructors.

**Unit-3****Operator Overloading and Type Conversions**

Defining operator overloading, Overloading unary operators, Overloading Binary operators, Rules for overloading operators, Type conversions.

**Inheritance and Polymorphism**

Introduction, defining derived classes, single inheritance, making a private member inheritable, multilevel inheritance, hierarchical inheritance, hybrid inheritance, virtual base classes, abstract classes, constructors in derived classes, polymorphism – introduction, pointers, pointers to objects, this pointers, pointers to derived classes, virtual functions, pure virtual functions.

**Unit-4****Console I/O Operations, Files and Templates**

C++ streams, C++ stream classes, Unformatted I/O operations, Formatted I/O operations, managing output with manipulators.

**Files:** Classes for file stream operations, opening and closing a file, detecting end of file, more about open(): file modes, file pointers and their manipulations, sequential input and output operations.

**Templates:** Function templates, Class templates Exceptions

**Reference Books:**

1. Object Oriented Programming with C++ , M.T. Somashekara, D.S. Guru, H.S. Nagendraswamy, K.S. Manjunatha, PHI Learning, New Delhi, 2012
2. Object Oriented Programming with C++ by E. Balagurusamy
3. Object Oriented Programming in C++ by Robert Lafore Techmedia Publication.
4. The complete reference C – by Herbert shieldt Tata McGraw Hill Publication.

**Unit I**

Introduction to Database System Concepts and Architecture

Databases and Database Users, Characteristics of the Database Approach, Actors on the Scene, Advantages of Using a DBMS

Data Models, Schemas and Instances, DBMS Architecture and Data Independence, Database Languages and Interfaces, The Database System Environment

Data Modeling Using the Entity-Relationship Model

Entity Types, Entity Sets, Attributes, and Keys, Relationship Types, Relationship Sets, Roles, and Structural Constraints, Weak Entity Types, ER Diagrams, Naming Conventions and Design Aspects

**Unit II**

Transaction- Transaction Concepts, States, ACID properties, Concurrent executions, Serializability Relational Data Model, Relational Constraints, and Relational Algebra

Relational Model Concepts, Relational Model Constraints and Relational Database Schemas, Basic Relational Algebra Operations, Additional Relational Operations, Examples of Queries in Relational Algebra.

**Unit III**

Normalization- Functional Dependencies, Transitive and Multivalued dependency, First Normal form, Second Normal Form, Third Normal Form and Boyce Codd Normal Form, Advantages of RDBMS- Codd's Rules.

**Unit-IV**

SQL-The Relational Database Standard

Data Definition, SQL Data Types and Schemas, Constraints, Basic Queries in SQL, Insert, Delete, and Update Statements in SQL, Set Operations, Aggregate functions, Views (Virtual Tables) in SQL, Joins – Inner, Outer and Self, Additional Features of SQL,DCL-commit, Rollback, Save-point, Grant privileges.

**Reference Books:**

1. Fundamentals of Database Systems by Navathe and Elmasri –Pearson Education, Fifth Edition.
2. Database Systems Concepts, 3<sup>rd</sup> edition by Abraham Silberschatz, Henry Korth and S. Sudarshan McGraw Hill International Editions.
3. Introduction to Database systems by CJ Date, Published by Addison-Wesley.
4. Principles of database systems by Ullman, Computer Science press, 1984.

**Unit-1**

Introduction to Java : Origin and features of Java. Java Program Structure, Java Tokens, Java statements, Java Virtual machine, Command Line Parameters, Java Variables and Data Types, Operators, Decision Making, Branching and looping statements.  
Classes, Objects and Methods used in Java: Class fundamentals, Methods, Constructors, Overloading, Inheritance, Interfaces, One and two dimensional arrays, Vectors, Strings, Wrapper Classes.

**Unit-2**

Java Packages: API packages, system packages, naming conventions, creating and accessing a package, adding a class to a package, hiding classes.  
Multi-threads Programming: Java thread Model, Main Thread, creating a Thread, Creating Multiple Threads, Extending the thread class, Stopping and blocking a thread, Life cycle of a thread, Managing Errors and Exceptions.

**Unit-3**

Applet Programming: Introduction, how applet differ from application, Applet life cycle, Applet tag, passing parameters to applet. Abstract Windows Toolkit: Components, Container, Panel, Label, Button, Checkbox, CheckboxGroup, Choice, List, TextField, TextArea, Scrollbars.  
Graphics Programming: The Graphics class, Lines and Rectangles, Circles and Ellipses, Drawing Arcs, Drawing Polygons, Line Graphs, Using Control Loops in Applets.

**Unit-4**

Managing Input/output Files in Java: Stream Classes, Byte Stream Classes, Character Stream Classes, Creation of Files, Reading/Writing characters, Reading/Writing Bytes, Handling Primitive Data Types, Concatenating and Buffering Files, Random Access Files.  
Networking: InetAddress, TCP/IP Client Sockets, TCP/IP Server Sockets, URL, URLConnection, JDBC connectivity

**Reference Books:**

1. Programming with Java – A PRIMER by E.Balagurusamy, Tata McGraw-Hill 3<sup>rd</sup> Edition
2. The Complete Reference - Java-2 by Patrick Naughton and Herbert Schildt Published by Tata McGraw-Hill India.
3. The Complete Reference – J2EE by Jim Keogh, published by Tata McGraw-Hill.

## **Data Communication and Networks**

**3:1:0**

### **Unit 1:**

Data Communication, Component and Basic Concepts – Introduction, Characteristics – Delivery, Accuracy, Timeliness and Jitter, Components

Topology – Mesh, Star, Tree, Bus, Ring and Hybrid Topologies

Transmission modes – Simplex, Half Duplex, Full Duplex

Categories of networks – LAN, MAN, WAN

Network Components – Signal Transmission – Analog Signaling, concept of ASK, FSK, PSK, Digital Signaling, concept of Unipolar, Polar, Return-to-Zero(RZ), Biphase,

### **Unit 2:**

Manchester, Differential Manchester, Non-Return-to-Zero (NRZ), Bit Synchronization, Asynchronous Bit Synchronization and Synchronous Bit Synchronization, Baseband and Broadband Transmissions.

Transmission Media - Guided Media – Twisted-Pair Cable, Coaxial Cable, Fiber-Optic Cable

Unguided Media – Radio Wave Transmission Systems, Microwave Transmission Systems, Infrared Transmission Systems and Satellite Communication System.

### **Unit – 3**

The OSI Model – Functions of all the Seven Layers

Networking Devices – Functions and Applications of Hub, Switches, Bridges, Repeaters

Internetworking Devices – Functions and Applications of Routers and Gateways

IP Addressing – Dynamic IP Addressing, Static IP Addressing, Types of IP Addresses

Protocols –TCP, UDP, IP, IPV4, IPV6, TCP/IP Suite, SMTP,ARP, RARP, OSPF, BGP, ALOHA

### **Unit– 4**

Packet Switching Networks – Network Services and Internal Network Operations, Packet Network Topology, Datagrams and Virtual Circuits, Connectionless Packet Switching, Virtual Circuit Packet Switching.

Routing Concepts – Routing Tables, Dijkstra's Shortest Path Routing Algorithm, Flooding, Distance Vector Routing, Congestion Control Algorithms-Leaky Bucket Algorithm.

Data Link Issues –Single bit error and Burst Error, concepts of Redundancy, Checksum, Single Bit Error correction and Hamming Code correction method.

### **Reference Books:**

1. Introduction to Data Communications and Networking by Behrouz Forouzan.
2. Computer Networks by Andrew S Tanenbaum.
3. Networking Essentials – Third Edition – Jeffrey S. Beasley, Piyasat Nilkaew

## **Computer Architecture**

**3:1:0**

### **Unit-1**

Basis Computer Architecture, Functional Organisation, Register Organisation, Arithmetic and Logic Unit, Central Processing unit, Instruction Formats, Addressing Modes. Data Transfer and Manipulation, interrupts RISC/CISC architecture.

### **Unit-2**

Register transfer and macro-operations, Register Transfer Languages (RTL). Arithmetic, Logic and Shift Macro-operations, Sequencing, Micro-program sequences.

Memory & Storage: Processor Vs. Memory speed: Cache memory. Associative memory, Virtual memory and Memory management

### **Unit-3**

Input / Output organization: Peripheral devices, I/O Asynchronous Data Transfer: Strobe Control, Data Transfer Schemes (Programmed, Initiated, DW, Transfer), I/O Processor.

### **Unit-4**

Pipelining and Vector Processor : Review of Pipelining, Examples of some pipeline in modern processors

Vector processors- Use and effectiveness, memory to memory vector architectures, vector register architecture,

SISD, MISD, MIMD, Single instruction multiple data stream (SIMD) architectures. Array processors, comparison with vector processors, example of array processors such as MMX Technology.

### **References**

1. Hayes J. P., "Computer Architecture & Organisation", McGraw Hill,
2. Hamacher and Zaki, "Computer Organisation", Tata McGraw Hill
3. Hwang and Briggs, "Computer Architecture & Parallel Processing", TMH



## **Theory of Languages and Automata**

**3:1:0**

### **Unit I**

Introduction: Strings, alphabets and languages, graphs and trees, inductive proofs, set notation, relations. Finite state systems, basic definitions, non-deterministic finite automata,

### **Unit II**

Finite Automata and Regular Expressions: finite automata with  $\epsilon$ - moves, regular expressions, two-way finite automata, finite automata with output, applications of finite automata.

Properties of Regular Sets: The pumping lemma for regular sets, closure properties of regular sets, decision algorithms for regular sets

### **Unit III**

Context Free Grammars: Motivation and Introduction, Context free grammars, derivation trees, simplification of context-free grammars, Chomsky normal form, Greibach normal form, the existence of inherently ambiguous context-free languages.

### **Unit IV**

Pushdown Automata: Definitions, Pushdown automata and context free languages, Properties of Context-Free Languages (CFL): The pumping lemma for CFL's, closure properties of CFL's, decision algorithms for CFL's.

### **Reference Book:**

**Introduction to Automata Theory, Languages, and Computation** - J D Ullman, J E Hopcraft, Narosa Publishing House.

**UNIT - 1**

**Fundamentals of Web:** Internet, WWW, Web Browsers, and Web Servers; URLs; MIME; HTTP; Security; the Web Programmers Toolbox. **HTML:** Origins and evolution of HTML; Basic syntax; Standard HTML document structure; Basic text markup, Hypertext Links; Lists; Tables; Forms; Frames.

**UNIT - 2**

**Cascading Style Sheets (CSS):** Introduction; Levels of style sheets; Style specification formats; Selector forms; Property value forms; Font properties; List properties; Color; Alignment of text; The Box model; Background images; The and tags;

**UNIT - 3**

**JavaScript:** Overview of JavaScript; Object orientation and JavaScript; General syntactic characteristics; Primitives, operations, and expressions; Screen output and keyboard input; Control statements; Object creation and modification; Arrays; Functions; Constructor; Pattern matching using regular expressions; Errors in scripts; Examples.

**UNIT -4**

**CGI Programming:** The Common Gateway Interface; CGI linkage; Query string format; CGI.pm module; A survey example; Cookies.

**Reference Books:**

1. **Programming the World Wide Web** – Robert W. Sebesta, 4<sup>th</sup> Edition, Pearson Education, 2008.
2. **Internet & World Wide Web How to H program** – M. Deitel, P.J. Deitel, A. B. Goldberg, 3<sup>rd</sup> Edition, Pearson Education / PHI, 2004.
3. **Web Programming Building Internet Applications** – Chris Bates, 3<sup>rd</sup> Edition, Wiley India, 2006.
4. **The Web Warrior Guide to Web Programming** – Xue Bai et al, Thomson, 2003.

**Unit-1**

Fundamentals of information systems: information systems in business, fundamentals of information systems solving business problems with information systems.

Introduction to e-business: e-commerce frame work, media convergence, consumer applications, organization applications.

**Unit - 2**

Information systems for business operations: business information systems, transaction processing systems, management information systems and decision support systems. Artificial intelligence technologies in business, information system for strategic applications and issues in information technology.

**Unit - 3**

Issues in managing information technology: managing information resources and technologies global information technology, management, planning and implementing change, integrating business change with it, security and ethical challenges in managing it, social challenges of information technology.

**Unit - 4**

Electronic data interchange (EDI): EDI concepts, applications in business – components of international trade, customs financial EDI, electronic fund transfer, manufacturing using EDI, digital signatures and EDI.

**References:**

1. Management information systems- managing information technology in the internet worked enterprise- jams. A O'brien - TMH publishing company limited, 2002.
2. Management information systems – Laudon and Laudon Publishers .
3. Management information systems- S Sadogopan, PHI
4. Information systems for modern management – G.R. Murdick PHI, 2<sup>nd</sup> edition.

**Unit-1:**

Probability: The concept of probability, the axioms and theorems, conditional probability, Independent Event's, Bayes Theorem. Random Variables and Probability Distributions:

Random variables, discrete probability distributions and Distribution functions: Bernoulli, Binomial, Hyper Geometric, Geometric, Poisson, Uniform.

**Unit 2:**

Continuous Probability distribution and Distributions functions: Exponential, Normal, Uniform, Concepts of Chi squared, T, joint Distributions, Independent random variables, Functions of random Variables.

**Unit-3:**

Mathematical Expectation: Definition, Functions of Random variables. The variance and Standard Deviation, Moments, Moment Generating Functions, Covariance, Correlation Coefficient. Sampling Theory & Estimation: Population and sample, Sampling with and without replacement, the sample mean, sampling distribution of means, proportions, differences and sums. The sample variance, the sample distribution of variances, Point estimates, Interval estimates. Variance analysis.

**Unit-4:**

Tests of Hypotheses and Significance: Statistical Decisions, Statistical hypotheses, Null Hypotheses, Tests of hypotheses and significance, Type I and Type II errors, level of significance, Tests involving the Normal distribution, One-Tailed and Two-tailed, Special tests of Significance for large and small samples, The Chi-square test for goodness of fit. Introduction to regression and curve fitting.

**References:**

1. Juscir S Trivedi, "Probability and Statistics with Reliability, Queuing and Computer Applications", Prentics Hall of India, 2000.
2. Papoulis and S. Unnikrishna Pillai, "Probability, Random Variables and Stochastic Processes, McGraw Hill, 4th Edition.
3. Richard A Johnson, Probability and Statistics for Engineers Prentice Hall, India 2002.

## **Mobile Communication**

**3:1:0**

### **Unit 1:**

Introduction, History of wireless communication, A simplified reference model, Signals, Antennas , Signal propagation, Multiplexing, modulation, spread spectrum, cellular system .

### **Unit 2:**

Medium access control, Motivation for specialized MAC,SDMA,FDMA,TDMA,CDMA, Comparison SDMA/FDMA/TDMA/CDMA, Telecommunication systems, GSM, DECT, TETRA, UMTS and IMT-2000

### **Unit 3:**

Satellite systems : History, Applications, basics, GEO. LEO, MEO, Routing ,Localization ,handover. Broadcast Systems :Overview, Cyclical repetition of data, Digital audio broadcasting, digital video broadcasting, convergence of broadcasting and mobile communication.

### **Unit 4:**

Wireless LAN, Infra-red v/s radio transmission, Ad-hoc networking, IEEE 802.11, Hiperlan, Bluetooth, Mobile Network layer , Mobile IP, Dynamic host configuration protocol, Mobile ad-hoc networks

### **References**

1. Mobile Communications by Jochen Schiller,, 2<sup>nd</sup> Edition, Pearson Education
2. Introduction To Digital Mobile Communication by Yoshihiko Akaiwa, Wiley India Pvt Ltd (2011)
3. Mobile Cellular Communication by Rao, Pearson Education (2012)

**UNIT-I:**

Introduction: Electronic commerce environment and opportunities: Background, The electronic commerce environment, Electronic market place technologies. Modes of electronic commerce: Overview, Electronic data interchange (EDI), Migration to open EDI, E-commerce with WWW/Internet, Commerce Net advocacy, Web commerce going forward. Approaches to safe E-commerce: Overview, Secure Transport Protocols, Secure Transactions, Secure electronic payment protocol (SEPP), Secure electronic Transaction (SET), Certificates for authentication, Security on web commerce & Enterprise network.

Payments and Security: Electronic cash and Electronic payment Schemes: Internet monetary payment and Security requirements, payment and purchase order process, On-line electronic cash. Master card/Visa secured electronic transaction: Introduction, Business Requirements, Concepts, Payment processing.

**UNIT-II:**

Consumer-oriented e-commerce: Introduction, Traditional retailing and e-retailing, benefits of e-retailing, Key success factors, Models of e-retailing, features of e-retailing, developing a consumer-oriented e-commerce system, The PASS model. Business-oriented e-commerce: Features of B2B e-commerce, Business models, Integration. Web advertising and web publishing: Traditional versus internet advertising, Internet techniques and strategies, Business models for advertising and their Revenues streams, pricing models and measurement of the effectiveness of Advertisements, web publishing- Goals and criteria, web side development Methodologies, logic design of the user interface.

**UNIT-III:**

E-Governance – An introduction, scope, Types of E- Governance- Public, Corporate, Urban, Public-Private Partnership. Models & issues for effective E-Governance. E-Democracy, role of E-Governance, E-Republic, E-Business. The stages of E-Government development, E-Govt Privacy, Security & Accessibility. Mobile security issues for E-Govt. ICT & E-Governance – Role of ICT(Information & Communication Technology). ICT infrastructure, Implementation of ICT policy. CRM(Customer Relationship Model)- Defining CRM in the public-service area. Standards in E-Governance, India Portal-Mission mode project, India development Gateway (InDG).

**UNIT-IV:**

E-Government in India- Introduction, Core policies, selection criteria, core infrastructure, support infrastructure, HRD/ Training- Technical assistance, awareness & assessment. National E-Governance Strategy, Implementation approach, governance structure. Draft policy Guidelines on

website development-infrastructure, Applicability, Aims & Objectives, Content structure, website features, Administration, maintenance/updating, website promotion, technical aspects, security 7 secrecy of information, infrastructure & Training.

**Refernces:**

1. Ravi Kalakota, Andrew B. Frontiers of Electronic Commerce, Addison Wesley 1996.
2. Daniel Minoli, Emma Minoli: web commerce Technology Handbook. Tata McGraw Hill 1999.
3. Henry Chan, Raymond Lee, Tharam Dillon, Elizabeth Cheng: E-Commerce Fundamentals and applications, John Wiley & Sons, 2002.
4. E-Governance by V.M. RAO
5. E-Governance by PANKAJ SHARMA.

## Unit-1

Introduction, Features of Linux, Linux Utilities-File handling utilities, File permissions, Process utilities, Disk utilities, Networking commands, Filters, Text processing utilities and Backup utilities, sed – scripts, operation, addresses, commands, applications, awk – execution, fields and records, scripts, operation, patterns, actions, functions, using system commands in awk.

## Unit-2

Working with the Bourne shell(bash): Introduction, shell responsibilities, pipes and input Redirection, output redirection, running a shell script, the shell as a programming language control structures, arithmetic in shell, shell script examples, interrupt processing, functions, debugging shell scripts.

## Unit-3

Files: File Concept, File System Structure, Inodes, File Attributes, File types, Library functions,the standard I/O and formatted I/O in C, stream errors, kernel support for files, System calls, File structure related system calls(File APIs), file and record locking, file and directory management – Directory file APIs, Symbolic links & hard links. Process concept.

## Unit-4

Multithreaded Programming: Differences between threads and processes, Thread structure and uses, Creating Threads, Thread Attributes, Thread Synchronization with semaphores and with Mutexes, Example programs. Sockets: Introduction to Sockets, example-client/server programs.

## Reference Books:

1. Unix System Programming using C++, T.Chan, PHI.(UNIT III to UNIT VIII)
2. Unix Concepts and Applications, 4th Edition, Sumitabha Das, TMH.
3. Beginning Linux Programming, 4th Edition, N.Matthew, R.Stones,Wrox, Wiley India Edition.
4. Advanced Programming in the Unix environment, 2nd Edition, W.R.Stevens, Pearson Education.
5. Unix Network Programming ,W.R.Stevens,PHI.



**Unit-1:**

Introduction, architecture of retrieval system, retrieval vs search, inductive and deductive way of retrieval, introduction to multimedia retrieval systems, validity measures- accuracy, precision, recall, f-measure, r-norm. sequencing with grouping, correct index.

**Unit-2:**

Review of the Relational Model, A Historical Progression, Information Retrieval as a Relational Application, Semi-Structured Search using a Relational Schema, Data Normalization,

**Unit-3:**

Data Clustering: Data, Features, Feature Space, Data Reduction, Proximity Indices and Similarity/Dissimilarity measures, Fuzzy Measures, Symbolic Measures, Clustering Strategies- Agglomerative Clustering, Divisive Clustering, Partitional Clustering, Cluster Validity, Applications of Data Clustering. Reduction through transformations.

**Unit-4:**

Text retrieval system: building up a corpus of text documents- preprocessing, feature extraction, different similarity and dissimilarity measures, searching a document based on query, approximations, dimensionality reduction through term selection, term elimination and combination of both, Hashing and indexing for quick retrieval, insertion and deletion of document from the corpus.

**Reference:**

1. David A. Grossman, Ophir Frieder- Information Retrieval: Algorithms and Heuristics, Second Edition, The Information Retrieval Series, Vol. 15, Springer-2004.
2. Anil K Jain, R. C. Dubes: Algorithms for Clustering Data
3. Research Papers

**Unit-1:**

Introduction, professional and ethical responsibility, emerging system properties, systems engineering, legacy systems, systems dependability, availability, reliability, safety and security. Software process models, process iteration, process activities, Project Management: Management activities, project planning, project scheduling, risk management. Software requirements, SRS.

**Unit-2:**

Requirement engineering process, System models and CASE workbenches. Software design: Architectural design- system structuring, control models, modular decomposition, domain specific architectures. Object oriented design: objects and object classes, an object oriented design process, design evolution.

**Unit-3:**

Verification and validation, Software testing – Different types of testing, Software cost estimation: productivity, estimation techniques, algorithmic cost modelling, project duration and staffing. Fundamentals of software quality management.

**Unit-4:**

Emerging Technologies: Security concepts, security risk management, design for security, system survivability. Service-oriented software engineering- services as reusable components, service engineering, software development with services. Aspect- oriented software development- The separation of concerns, aspects, join points and point cuts, software engineering with aspects.

**References:**

1. Software Engineering, Ian Sommerville, 8<sup>th</sup> Edition, Pearson Education Ltd.,
2. Software Engineering – A practitioners approach, Roger. S. Pressman, Tata-McGraw Hill 6th Edition.
3. Fundamentals of software engineering, Rajib Mall, Phi learning Pvt. Ltd, 3<sup>rd</sup> edition.

**Unit 1:**

Introduction to digital image processing, Stages, Application areas, components, electromagnetic spectrum, image sensing and acquisition, image sampling and quantization, relationships between pixels, Enhancement in spatial domain: Intensity transformation functions.

**Unit 2:**

Spatial filtering, Frequency domain enhancement: Discrete Fourier transform (DFT) properties of the 2D discrete Fourier transform, filtering in the frequency domain, Introduction to Color image processing.

**Unit 3:**

Segmentation – Intensity based – point, line and edge. Region based – Boundaries, region growing, Thresholding, splitting and merging, segmentation by morphological watersheds, the use of motion in segmentation.

**Unit 4:**

Morphological operations: Preliminaries, opening and closing, the hit-or-miss transformation, some basic morphological algorithms, gray-scale images. Image representation

Some applications: Document image processing, Biometrics, robot vision, medical applications.

**Reference books:**

1. R. C. Gonzalez, R. E. Woods, Digital Image Processing, 3-rd ed. Prentice Hall, Pearson publication.
2. Anil K Jain, Digital Image Processing, PHI Publication
3. Milan Sonka, Image Processing, Analysis, and Machine Vision, 3rd Edition, CL Engineering(2013)

## **Graph Theory**

**3:0:1**

### **Unit-1**

Fundamental concepts of Graph, Vertices, Edges, Degree, Isolated Vertices, Pendent Vertices, Regular graph, Fundamental theorems, Simple and general graphs, Complete and Infinite graphs, Adjacency and Incidence Matrix structures, Concept of Isomorphism, Review of graph in analysis and design of algorithms

### **Unit-2**

Connectivity, Dis-connectivity, Paths, Shortest paths, Circuits, Graph operations, Euler and Hamiltonian graphs, Travelling salesman problem, Weighted graphs, shortest distances, Path matrix

### **Unit-3**

Trees, Spanning Trees, Fundamental Circuits, Tree center, Cut-sets, Fundamental cut-sets, Connectivity and seperability, Circuit matrix, Cut set matrix

### **Unit-4**

Planarity, Kuratowski's graphs, Faces, Euler formula, Duality, Dual properties, Chromaticity-vertex coloring, region coloring, Bipartite graphs

### **References**

1. Graph Theory with Applications to Engineering and Computer Science by Narsingh Deo.

**Unit 1:**

Introduction-computer security concepts, attacks, security services, security mechanisms; Classical encryption techniques-symmetric cipher models, substitution techniques, transposition techniques, rotor machines

**Unit 2:**

Symmetric ciphers-Block cipher principles; DES-Algorithm, strengths and weaknesses of DES, attacks on DES and defense, multiple encryptions; Asymmetric ciphers-Essential mathematics, public key cryptography,

**Unit-3**

RSA, Diffie Hellman key exchange, random number generation, Data integrity and authentication Hash functions; MAC; Digital signatures;

**Unit-4**

Key management; Authentication, Web and system security, Web security; IP security; E mail security; System security-intruders, malicious software, firewalls

**References:**

1. Cryptography and Network Security - Principles and Practice, William Stallings, PEARSON
2. Cryptography and Network Security, Atul Kahate, Tata McGraw Hill

## **Distributed Computing**

**3:1:0**

### **Unit-1:**

Introduction to distributed systems (DS), Design goals, transparencies, fundamental issues, interconnection networks, Client server computing

### **Unit-2:**

Naming and binding, Distributed co-ordination, Process synchronization, Inter-process communication

### **Unit-3:**

Dead locks in distributed systems, Load Scheduling and balancing techniques, Agreement protocols

### **Unit-4:**

Distributed file system design, Distributed database system : A Case study

## **References**

1. Andrew S Tanenbaum and Maarten van Steen : Distributed Systems: Principles and paradigms, PHI(2002)
2. T.L. Casavant and M. Singhal : Distributed Computing Systems, IEEE computing society press (1994)
3. M. Raynal and J. Howlett : Distributed algorithms and protocols, Wiley and Sons (1988)

# **REAL TIME OPERATING SYSTEMS (3:1:0)**

## **Introduction to OS and RTOS**

Architecture of OS (Monolithic, Microkernel, Layered, Exo-kernel and Hybrid kernel structures), Operating system objectives and functions, Virtual Computers, Interaction of O. S. & hardware architecture, Evolution of operating systems, Batch, multi programming. Multitasking, Multiuser, parallel, distributed & real –time O.S.

## **Process Management of OS/RTOS**

Uniprocessor Scheduling: Types of scheduling, scheduling algorithms: FCFS, SJF, Priority, Round Robin, UNIX Multi-level feedback queue scheduling, Thread Scheduling, Multiprocessor Scheduling concept, Real Time Scheduling concepts.

## **Process Synchronization**

Concurrency: Principles of Concurrency, Mutual Exclusion H/W Support, software approaches, Semaphores and Mutex, Message Passing, Monitors, Classical Problems of Synchronization: Readers-Writers Problem, Producer Consumer Problem, Dining Philosopher problem. Deadlock: Principles of deadlock, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, An Integrated Deadlock Strategies.

## **Memory and I/O Management:**

Memory Management requirements, Memory partitioning: Fixed, dynamic, partitioning, Buddy System Memory allocation Strategies (First Fit, Best Fit, Worst Fit, Next Fit), Fragmentation, Swapping, Segmentation, Paging, Virtual Memory, Demand paging, Page Replacement Policies (FIFO, LRU, Optimal, clock) ,Thrashing, Working Set Model.

I/O Management and Disk Scheduling: I/O Devices, Organization of I/O functions, Operating System Design issues, I/O Buffering, Disk Scheduling (FCFS, SCAN, C-SCAN, SSTF), Disk Caches.

## **RTOS Application Domains**

Comparison and study of RTOS: Vxworks and  $\mu$ COS – Case studies: RTOS for Image Processing – Embedded RTOS for voice over IP – RTOS for fault Tolerant Applications – RTOS for Control Systems.

## **Reference Books:**

1. Wayne Wolf, “*Computers as Components: Principles of Embedded Computing System Design,*” 2/e, Kindle Publishers, 2005.
2. Tanenbaum, “*Modern Operating Systems,*” 3/e, Pearson Edition, 2007.
3. Jean J Labrosse, “*Embedded Systems Building Blocks Complete and Ready-to-use Modules in C,*” 2/e, 1999.
4. C.M.Krishna and G.Shin, “*Real Time Systems,*” McGraw-Hill International Edition, 1997.

## **EMBEDDED SYSTEMS** (3:1:0)

**Introduction to Embedded Systems:** Introduction to Embedded Systems – The build process for embedded systems- Structural units in Embedded processor , selection of processor & memory devices- DMA – Memory management methods- Timer and Counting devices, Watchdog Timer, Real Time Clock, In circuit emulator, Target Hardware Debugging.

**Embedded Networking:** Embedded Networking: Introduction, I/O Device Ports & Buses– Serial Bus communication protocols – RS232 standard – RS422 – RS485 – CAN Bus -Serial Peripheral Interface (SPI) – Inter Integrated Circuits (I2C) –need for device drivers.

**Embedded Firmware Development Environment:** Embedded Product Development Life Cycle- objectives, different phases of EDLC, Modelling of EDLC; issues in Hardware-software Co-design, Data Flow Graph, state machine model, Sequential Program Model, concurrent Model, object oriented Model.

**RTOS Based Embedded System Design:** Introduction to basic concepts of RTOS- Task, process & threads, interrupt routines in RTOS, Multiprocessing and Multitasking, Preemptive and non preemptive scheduling, Task communication shared memory, message passing-, Inter process Communication – synchronization between processes-semaphores, Mailbox, pipes, priority inversion, priority inheritance, comparison of Real time Operating systems: Vx Works, µC/OS-II, RT Linux.

**Embedded System Application Development:** Case Study of Washing Machine- Automotive Application- Smart card System Application,.

### **Reference Books:**

- Rajkamal, ‘Embedded System-Architecture, Programming, Design’, Mc Graw Hill, 2013.
- Peckol, “Embedded system Design”, John Wiley & Sons,2010
- Lyla B Das,” Embedded Systems-An Integrated Approach”, Pearson, 2013
- Shibu. K.V, “Introduction to Embedded Systems”, Tata Mcgraw Hill,2009.



- Elicia White, "Making Embedded Systems", O'Reilly Series, SPD, 2011.
- Han-Way Huang, "Embedded system Design Using C8051", Cengage Learning, 2009.
- Rajib Mall "Real-Time systems Theory and Practice" Pearson Education, 2007.

## **BIG DATA ANALYTICS (3:0:1)**

**Introduction to Big Data Analytics:** Big Data Overview, State of practice in analytics, Role of Data Scientists, Examples of Big Data Analytics, Data Analytics Lifecycle, Components of Hadoop, Analyzing Big data with Hadoop, Design of HDFS, Developing a Map reduce Application.

**Map Reduce:** Distributed File System(DFS), Map Reduce, Algorithms using Map Reduce, Communication cost Model, Graph Model for Map Reduce Problem.

**Hadoop Environment:** Setting up a Hadoop Cluster, Hadoop Configuration, Security in Hadoop, Administering Hadoop, Hadoop Benchmarks, Hadoop in the cloud.

**Big Data Analytics Methods using R:** Introduction to R-Attributes, R Graphical user interfaces, Data import and export, attribute and Data Types, Descriptive Statistics, Exploratory Data Analysis.

**Statistical methods for evaluation:** Hypothesis Testing, Difference of Means, Wilcoxon Rank-Sum Test, Type I and Type II errors, power and sample size, ANOVA.

**Advanced Analytics - technologies and tools:** Analytics for unstructured data, The Hadoop ecosystem – pig – Hive- HBase- Mahout- NoSQL.

## **Reference Books**

1. Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data by EMC Education Services, 2015, publishing.
2. Anand Raja Raman and Jeffrey David Ullman, Mining of Massive Datasets, 2012, Cambridge University Press.
3. Tom White, Hadoop: The Definitive Guide, 3rd Edition, O'Reilly Media

## **CLOUD COMPUTING (3:1:0)**

**Introduction:** Cloud models-Evolution of Cloud Computing –System Models for Distributed and Cloud Computing – NIST Cloud Computing Reference Architecture – On-demand Provisioning – Elasticity in Cloud – deployment models – service models-cloud service providers

**Virtualization:** Basics of Virtualization - Types of Virtualization - Implementation Levels of Virtualization, Virtualization Structures - Tools and Mechanisms – resource sharing and resource pooling Desktop Virtualization – Server Virtualization.

**Cloud Infrastructure:** Architectural Design of Compute and Storage Clouds – Layered Cloud Architecture Development – Design Challenges - Inter Cloud Resource Management – Resource Provisioning and Platform Deployment – Global Exchange of Cloud Resources.

**Programming Model:** Parallel and Distributed Programming Paradigms – Map Reduce, Twister and Iterative Map Reduce – Hadoop Library from Apache – Mapping Applications - Programming Support.

**Security in the Cloud:** Security Overview – Cloud Security Challenges – Access control mechanisms – Security Governance – Risk Management – Security Monitoring – Security Architecture Design – Virtual Machine Security.

**Enterprise Cloud-Based High Performance Computing (HPC):** Overview of High Performance Computing (HPC) on Cloud-Enterprises HPC applications (high-performance grid computing, high-performance big data computing/analytics, high performance reasoning)-HPC Cloud vendor solutions: compute grids (Windows HPC, Hadoop, Platform Symphony ,Gridgain), data grids (Oracle coherence, IBM Object grid, Cassandra, HBase, Memcached, HPChardware (GPGPU, SSD, Infiniband, Non-blocking switches)

**Setting up own Cloud:** Cloud setup-How to build private cloud using open source tools-Understanding various cloud plugins-Setting up your own cloud environment-Autoprovisioning-Custom images-Integrating tools like Nagio-Integration of Public and Private cloud.

## **Reference Books**

1. Kai Hwang, Geoffrey C Fox, Jack G Dongarra, Distributed and Cloud Computing, From
2. Parallel Processing to the Internet of Things, 2012, 1st Edition, Morgan Kaufmann Publishers.
3. Katarina Stanoevska-Slabeva, Thomas Wozniak, Santi Ristol, Grid and Cloud Computing – A Business Perspective on Technology and Applications, 2010, Springer.
4. John W.Rittinghouse and James F.Ransome, Cloud Computing: Implementation, Management, and Security”, 2010, CRC Press.
5. Toby Velte, Anthony Velte, Robert Elsenpeter, Cloud Computing, A Practical Approach, 2009, TMH.
6. George Reese, Cloud Application Architectures: Building Applications and Infrastructure in the Cloud O'Reilly, 2009.

## **MOBILE APPLICATION DESIGN AND DEVELOPMENT (3:0:1)**

**Mobile application development:** A brief history of mobile, Mobile ecosystem, Designing for context, Developing a Mobile Strategy, Mobile Information Architecture, Mobile Design, Types of mobile application

**Technologies:** HTML5-elements, form, graphics, media, CSS3-2Dtransforms, 3Dtransforms, transitions, animations, images, Javascript-forms, objects, error handling, validations, JQuery-selectors, effects, traversing, Ajax

**Android programming:** Android toolkit, Java for android, components of an Android Application.

**Android software development:** Eclipse Concepts and Terminology, Eclipse Views and Perspectives, Eclipse and Android, Effective java for Android.

**Android Framework:** Building a View, Fragments and Multiplatform Support, Handling and Persisting Data.

**Android UID principles:** Designing powerful user interfaces, handling advanced user input, designing accessible applications.

**Drawing, Animations and Graphics programming:** Developing 2D graphics applications, working with animations developing Android 3D graphics applications, using Android NDK.

### **Reference Books**

1. Zigurd Mednieks, Laird Dornin, G. Blake Meike, and Masumi Nakamura, Programming Android, 2011, 1st Edition, O'Reilly Media.
2. Jonathan Stark, Building iPhone Apps with HTML, CSS and JavaScript, 2011, 1st Edition, O'Reilly Media.
3. Brian fling, Mobile Design and Development, 2009,1st Edition, O'Reilly Media.
4. Paul Deitel, Harvey Deitel, Abbey Deitel, Michael Morgana, Android for Programmers An App-Driven Approach, 2012, 2nd Edition, Deitel Developer Series, Pearson Education.

## **NETWORK AND INFORMATION SECURITY (3:1:0)**

**Introduction:** Threats, vulnerabilities, controls, Confidentiality, integrity, availability, Attackers and attack types.

**Authentication, Access Control and:** Authentication, Identification Versus Authentication, Authentication Based on biometrics, Authentication Based on Tokens, Federated Identity management, Multifactor Authentication, Secure Authentication. Implementing Access Control, Procedure-Oriented Access Control, Role-Based Access Control.

**Cryptography:** Problems Addressed by Encryption Terminology, DES: The Data Encryption Standard, AES: Advanced Encryption System, Public Key Cryptography, Trust Certificates: Trustable Identities and Public Keys, Digital Signatures.

**Browser Attacks:** Browser Attack Types, How Browser Attacks Succeed: Failed Identification and Authentication, Web Attacks Targeting Users False or Misleading Content, Malicious Web Content Protecting Against Malicious Web Pages, Foiling Data Attacks, Email Attacks.

**Cyber Security:** Cyber Security Fundamentals – Attacker techniques and motivation – Malicious Code – Defence and Analysis Techniques – Memory Forensics – Honeypots – Malicious code Naming – Automated code analysis systems – Intrusion Detection System.

**Replication:** Self-Replicating Malicious Code ,Evading Detection and Elevating Privileges, Persistent Software Techniques, Rootkits, Spyware, Virtual Machine Detection.

**Cloud Security:** Cloud Computing Concepts, Service Models, Deployment Models, Moving to the Cloud, Risk Analysis Cloud Provider Assessment, Switching Cloud Providers, Cloud Security Tools and Techniques Data Protection in the Cloud, Cloud Application Security, Cloud Identity Management.

### **Reference Books**

1. Charles P. Fleegeer, Security in Computing, 2011, 5th edition, Prentice Hall, New Delhi.
2. P.W.Singer and Allan Friedman, Cyber security and cyber war what everyone needs to Know, 2014, 1st edition, Oxford university press,USA.
3. Taylor Sutton Finch Alexander, Information Security Management Principles, 2012, 2nd edition BCS Learning and development Limited, United Kingdom.

## **INTERNET OF THINGS (2:1:1)**

**Introduction to IoT:** Definition and Characteristics, Physical Design of IoT, Logical Design of IoT, IoT Enabling Technologies.

**M2M and IoT:** Introduction to M2M, Difference between IoT and M2M, SDN and NFV for IoT.

**IoT Protocols:** IEEE 802.15.4, BACNet Protocol, Modbus, KNX, Zigbee Architecture, 6LoWPAN, RPL

**Developing Internet of Things:** IoT Platforms Design Methodology, Python packages of Interest for IoT, IoT Physical Devices and Endpoints

**IoT and Cloud:** IoT Physical Servers and Cloud Offerings, IoT Tools:Chef,Puppet

**Data Analytics for IoT:** Big Data Platforms for the IoT, Hadoop Map Reduce for Batch Data Analysis, Apache Oozie Workflows for IoT Data Analysis, In-Memory Analytics using Apache Spark, Apache Storm for Real Time Data Analysis, Sustainability Data and Analytics in Cloud based M2M Systems, Fog Computing: A Platform for IoT and Analytics

**Domain Specific IoTs:** Home Automation, Cities, Environment, Energy, Retail, Logistics, Agriculture, Industry, Health and Lifestyle, Virtual Reality Internet Advertising, Intelligent Transportation Systems, Health Information System: Genomics Driven Wellness Tracking and Management System(Go-WELL)

## **Reference Books**

1. Arshdeep Bahga, Vijay Madisetti, Internet of Things: A Hands-on Approach, 2015, 1st Edition, Universities Press.
2. Olivier Hersent, David Boswarthick, Omar Elloumi, The Internet of Things – Key applications and Protocols, 2012, Wiley Publication.
3. Honbo Zhou, The Internet of Things in the Cloud: A Middleware Perspective, 2012, CRC Press.
4. Dieter Uckelmann; Mark Harrison; Florian Michahelles Architecting the Internet of Things, 2011, Springer.

## **ENTERPRISE RESOURCE PLANNING (3:1:0)**

**Introduction to Enterprise Resource Planning:** Introduction, Benefits of ERP, Business Process Reengineering, Data Warehousing, Data Mining, Supply Chain Management.

**Reasons for the Growth of ERP:** Reasons for the Growth of ERP, Scenario and Justification of ERP in India, Evaluation of ERP, Various Modules of ERP, and Advantages of ERP.

**Understanding ERP:** Overview of Enterprise, Integrated Management Information, Business Modeling, ERP for Small Businesses, ERP for Make to Order Companies.

**Business Process Mapping:** Business Process Mapping in ERP, ERP Implementation Process, Hardware Environment for ERP Implementation.

**ERP Implementation:** Precautions in ERP Implementation, ERP Post Implementation Options, Guidelines for ERP Implementation, Pre-evaluation Screening, Package Evaluation, Project Planning Phase, Gap Analysis, Hidden Cost, Vendors, Consultants, Human Resource, Re-Engineering, Configuration, Implementation, Team Training, Testing, Going Live and End User Training, Post Implementation.

**ERP and Related Technologies:** Business Process Re-engineering, Management Information System, Executive Information System (EIS), Decision Support Systems (DSS), Supply Chain Management.

**ERP Modules:** ERP Finance Module, Plant Maintenance, Quality Management, Materials Management Module.

**ERP and E-commerce:** Future Directives in ERP, ERP and Internet, Critical Factors Guiding Selection and Evaluation of ERP, Strategies for Successful ERP Implementation, Critical Success Factors in ERP Implementation, Failure Factors in ERP Implementation, Integrating ERP into Organization, ERP Software and Tools

## **Reference Books**

1. **Concepts in Enterprise Resource Planning** 4th Edition by Ellen Monk and Bret Wagner
2. **Modern ERP: Select, Implement, and Use Today's Advanced Business Systems** by Marianne Bradford
3. **Enterprise Resource Planning: Concepts and Practice, Second Edition** New Title Edition, Kindle Edition By Vinod Kumar and Venkitakrishnan, N. K. Garg

## **PYTHON PROGRAMMING (2:0:2)**

**Introduction:** History of Python, Need of Python Programming, Applications Basics of Python Programming Using the REPL(Shell), Running Python Scripts, Variables, Assignment, Keywords, Input-Output, Indentation.

**Types, Operators and Expressions:** Types – Integers, Strings, Booleans; Operators- Arithmetic Operators, Comparison (Relational) Operators, Assignment Operators, Logical Operators, Bitwise Operators, Membership Operators, Identity Operators, Expressions and order of evaluations Control Flow- if, if-elif-else, for, while break, continue, pass

**Data Structures Lists:** Operations, Slicing, Methods; Tuples, Sets, Dictionaries, Sequences. Comprehensions.

**Functions:** Defining Functions, Calling Functions, Passing Arguments, Keyword Arguments, Default Arguments, Variable-length arguments, Anonymous Functions, Fruitful Functions (Function Returning Values), Scope of the Variables in a Function- Global and Local Variables. Modules: Creating modules, import statement, from. Import statement, name spacing, Python packages, Introduction to PIP, Installing Packages via PIP, Using Python Packages

**Object-Oriented Programming OOP in Python:** Classes, ‘self-variable’, Methods, Constructor Method, Inheritance, Overriding Methods, Data hiding, Error, and Exceptions: Difference between an error and Exception, Handling Exception, try except for block, Raising Exceptions, User Defined Exceptions

**Brief Tour of the Standard Library:** Operating System Interface – String Pattern Matching, Mathematics, Internet Access, Dates and Times, Data Compression, Multithreading, GUI Programming, Turtle Graphics Testing: Why testing is required ?, Basic concepts of testing, Unit testing in Python, Writing Test cases, Running Tests.

### **Reference Books:**

1. Charles Dierbach, "Introduction to Computer Science Using Python", 1st Edition, Wiley India Pvt Ltd.
2. Mark Lutz, "Programming Python", 4th Edition, O'Reilly Media, 2011.
3. Wesley J Chun, "Core Python Applications Programming", 3rd Edition, Pearson Education India, 2015.
4. Roberto Tamassia, Michael H Goldwasser, Michael T Goodrich, "Data Structures and Algorithms in Python", 1<sup>st</sup> Edition, Wiley India Pvt Ltd, 2016.
5. Reema Thareja, "Python Programming using problem solving approach", Oxford university press, 2017.
6. Python Programming: A Modern Approach, Vamsi Kurama, Pearson
7. Learning Python, Mark Lutz, Orielly
8. Introduction to Python, Kenneth A. Lambert, Cengage.

## OPEN ELECTIVE COURSES

### Computer Fundamentals and Programming Concepts

3:0:1

#### Unit-1

Introduction to Computers: History, Generations of Computers, Application of computers in various fields, Classification of computers

Block diagram of a computer, Input and output devices – Keyboard, , Mouse and other input devices, Output devices – Monitor, Printer and Audio output devices, Storage devices – Primary and secondary storage – RAM, ROM and its types, Magnetic storage devices, Optical Storage devices, measuring device performance.

#### Unit-2

Data and Information – Representation of different types of data, Data processing cycle, Factors affecting processing speed, Data processing types. Computer Software, Types of Software, Operating System-Introduction, Types of Operating System.

Problem solving aspects – Introduction, stages in problem solving , Introduction to algorithms and flow charts, Programming languages – Types of programming languages, Basic programming constructs - sequence, selection and iteration.

#### Unit-3

Introduction to C, Features, Basic structure, Programming constructs : Constants – Types of constants, Variables – declaration of variables, Identifiers , Data types in C – int, float and char with their modifiers.

Operators and Expression: Arithmetic, Relational, logical, assignment, increment and decrement, conditional, bitwise and special operators, Expression – Arithmetic, relational and logical expressions, Evaluation of expressions, Type conversions in expressions, Operator precedence and associativity, Mathematical functions. Managing Input and Output Operations, Reading a character, writing a character, formatted input and formatted output

#### Unit-4

Decision Making and Branching

Decision making with IF statement, Simple IF statement, The IF ELSE statement, Nesting of IF ... ELSE statements, The ELSE IF ladder, the switch statement, the ?: Operator, The GOTO statement.

Decision Making and Looping

The WHILE statement, The DO statement, The FOR statement, Jumps in loops

Arrays



One-dimensional arrays, Two-dimensional arrays, Initializing two-dimensional arrays., Strings in C – string handling functions, Introduction to functions in C – Advantages of functions, Defining and calling a function

### **Reference Books:**

1. Problem Solving with C, M.T. Somashekara, PHI Learning, New Delhi, 2009
2. Programming in ANSI C 2<sup>nd</sup> Edition by E Balaguruswamy Published by Tata McGraw Hill.
3. Computer Concepts and C programming by P.B. Kotur
4. Let Us C by Yashwant Kanetker, BPB Publication

## **E-Technology**

**3:0:1**

### **UNIT-I:**

E-Governance – An introduction, scope, Types of E- Governance- Public, Corporate, Urban, Public-Private Partnership. Models & issues for effective E-Governance. E-Democracy, role of E-Governance, E-Republic, E-Business. The stages of E-Government development, E-Govt Privacy, Security & Accessibility. Mobile security issues for E-Govt.

ICT & E-Governance – Role of ICT(Information & Communication Technology). ICT infrastructure, Implementation of ICT policy. CRM (Customer Relationship Model)- Defining CRM in the public-service area.

### **UNIT-2**

Standards in E-Governance, India Portal-Mission mode project, India development Gateway (InDG). E-Government in India- Introduction, Core policies, selection criteria, core infrastructure, support infrastructure, HRD/ Training- Technical assistance, awareness & assessment. National E-Governance Strategy, Implementation approach, governance structure.

Draft policy Guidelines on website development-infrastructure, Applicability, Aims & Objectives, Content structure, website features, Administration, maintenance/updating, website promotion, technical aspects, Secrecy of information

### **UNIT-3**

Introduction to Computer Networks – Network elements, Objectives and applications of networks, Network types – LAN, WAN and MAN, intranet v/s Internet, Network topologies, Internet services – E-mail, browsing, File services, Net banking, OSI ISO reference model – Functions of different layers

## **UNIT-4**

Web Designing using HTML: Introduction to HTML, HTML tags, Different types of list – ordered, unordered and definition, Linking multiple web pages, Tables in HTML

### References

1. E-Governance by V.M. RAO
2. E-Governance by PANKAJ SHARMA.
3. Computer Fundamentals by V. Rajaraman, PHI Publication
4. Beginning HTML, XHTML, CSS, And Javascript 1st Edition, Jon Duckett.
5. HTML 5 for Beginners, Firuza Aibara, Shroff publisher (2012)

## **High Performance Computing**

**2:1:1**

### **Unit 1**

Introduction: The need for parallel computers, Models of computation, Analyzing parallel algorithms, Expressing parallel algorithms,

### **Unit 2**

The Computational Power of the PRAM model: Comparison between RAM and PRAM models, Graph coloring on PRAM, Parallel computation thesis, NC and P-complete classes

### **Unit 3**

Selection: Sequential algorithms, Desirable properties for parallel algorithms, An EREW algorithm for parallel selection, Merging: A network for merging, Merging on the CREW model.

### **Unit 4**

Parallel Sorting Algorithms: Bubble, Quick, Odd-Even Transposition sort, Shear sort.

### **References:**

1. Michael Quinn, Parallel Programming in C with MPI and OpenMP (preprint), McGraw-Hill.
2. R. Greenlaw, H.J. Hoover, W.L. Ruzzo, Limits to Parallel Computation: P-Completeness Theory, Oxford University Press, New York, 1995.

3. V. Kumar, A. Grama, A. Gupta, G. Karypis, Introduction to Parallel Computing, The Benjamin/Cummings Publishing Company, Redwood City, California, 1994.
4. T. Cormen, C. Leiserson, R. Rivest, Introduction to Algorithms, The MIT Press, Cambridge, 1992.
5. S. G. Akl, The Design and Analysis of Parallel Algorithms, Prentice Hall, 1989.
6. M. J. Quinn, Parallel Computing, McGraw Hill, 1994.
7. F.T. Leighton, Introduction to Parallel Algorithms and Architectures: Arrays, Trees, Hypercubes, Morgan Kaufmann Publishers, San Mateo, California, 1992.
8. D.P. Bovet, P. Crescenzi, Introduction to The Theory of Complexity, Prentice Hall, N.Y., 1994.
9. Al Geist, et al., PVM: Parallel Virtual Machine - a User's Guide and Tutorial for Networked Parallel Computing, The MIT Press, Cambridge, 1994.