

Annexure A: Course Structure & Detailed Syllabus MCA

**BABASAHEB BHIMRAO AMBEDKAR UNIVERSITY**  
Department of Computer Science  
(MCA)

Annexure 'A'

W.E.F. 2016-17

FIRST YEAR

1<sup>st</sup> Semester

Paper Code	Paper Title	Paper Type	Credit
MCA-101	Computer Architecture	Non- Core	06
MCA-102	Discrete Structures	Foundation- Compulsory	06
MCA-103	Object Oriented Programming & C++	Core	06
MCA-104	Computer Based Numerical & Statistical Techniques	Core	03
MCA-105	Programming Lab-I	Core	03
MPDC-105	Remedial Language Course **	Foundation- Elective	01

**Total Semester Credit: 24**

2<sup>nd</sup> Semester

Paper Code	Paper Title	Paper Type	Credit
MCA-201	Graph Theory and Combinatorics	Core	06
MCA-202	System Programming	Core	06
MCA-203	Data Structure	Foundation- Compulsory	06
MCA-204	Computer Based Optimization Techniques	Non- Core	03
MCA-205	Programming Lab-II	Core	03
MPDC-205	Moral Studies **	Foundation- Compulsory	01

## SECOND YEAR

### 3<sup>rd</sup> Semester

Paper Code	Paper Title	Paper Type	Credit
MCA-301	Operating System	Core	06
MCA-302	Analysis and Design of Algorithm	Core	06
MCA-303	Software Engineering	Non- Core	06
MCA-304	Internet and Java Programming	Foundation- Compulsory	03
MCA-305	Programming Lab III	Core	03
MPDC-305	Community Service **	Foundation- Compulsory	01

**Total Semester Credit: 24**

### 4<sup>th</sup> Semester

Paper Code	Paper Title	Paper Type	Credit
MCA-401	Data Base Management System	Core	06
MCA-402	Compiler Design	Non- Core	06
MCA-403	Data Communication & Computer Network	Core	06
MCA-404	<b>Elective Paper-I</b>	Elective	03
MCA-405	Programming Lab IV	Core	03
MPDC-405	Ambedkar Studies **	Foundation- Compulsory	01

**Total Semester Credit: 24**

**THIRD YEAR**

**5<sup>th</sup> Semester**

Paper Code	Paper Title	Paper Type	Credit
MCA-501	Artificial Intelligence	Core	06
MCA-502	Computer Graphics	Core	06
MCA-503	<b>Elective Paper II</b>	Elective	06
MCA-504	<b>Elective Paper III</b>	Elective	03
MCA-505	Programming Lab V	Core	03

**Total Semester Credit: 24**

**6<sup>th</sup> Semester**

Paper Code	Paper Title	Paper Type	Total Credit
MCA-601	Industrial Training and Project  (I) Internal assessment (II) External Assessment (Dissertation & Viva-voce examination)	Core	24

The weightage of internal and external assessment will be in the ration of 30% and 70%

**Internal assessment will be done as follows**

There will be three components having equal weightage

- i) SRS / Synopsis
- ii) Design of Project
- iii) Project report

Each student will have to submit relevant documents for each of the above components to his/her supervisor/guide through email/ physical presence and evaluation of the same will be done by the concern supervisor/guide

## **Total Credit of all Semesters- 144**

### **Note:**

1. Students of the programme can chose any other course equal or higher credits from any other department of the university in leu of non-core and elective course under the CBCS programme. However, all of these courses are available to students of other departments under the CBCS programme
2. Credit not to be counted for paper market as \*\*

### **A) List of Electives for Semester IV (Elective-I):-**

1. Modeling & Simulation
2. Data Mining
3. Real Time System
4. Software Project Management
5. Electronic Commerce
6. Parallel Computing

### **B) List of Electives for Semester IV (Elective-II & III):-**

#### **(i) Electives II (6 Credit)**

1. Distributed Computing
2. Embedded Systems
3. Soft Computing
4. Digital Image Processing

#### **(ii) Electives III (3 Credit)**

1. Advance Database Management System
2. Neural Network
3. Natural Language Processing
4. Digital Signal Processing
5. Mobile Computing

**DETAILED SYLLABUS**  
**MASTER OF COMPUTER APPLICATIONS (MCA)**  
W.e.f. 2016-17

First Year

Semester I

**MCA-101**      **Computer Architecture (3-1-0)**

**Credit-06**

**(Contact Hours: 45 Max.)**

**UNIT-I**

Introduction to Computer Organization, I/O Storage Devices, CPU Processor, Data Representation, Number System, Computer Arithmetic and Boolean Algebra, Generations of Computer, Introduction to Operating Systems, and system Software.

**UNIT-II**

Flowcharts & Algorithms, Programming Languages and Their Evolution, Level and Classification of Programming Language-Machine, Assembly & High Level Languages, Logic Families. DTL, TTL, ECL, NMOS, PMOS, CMOS

**UNIT-III**

Logic Gates, K-Map and Application, Adder and Sub tractor, Multiplexer & Demultiplexer, Encoder circuits, Flip Flops, R-S, J-K & T Flip Flops, Counters & Registers.

**UNIT-IV**

Types of Memories, RAM, ROM PROM, EPROM, Cache Memory, Bubble Memory, Secondary Memory, Memory Devices & Properties, Instructions format & Addressing Techniques, I/O Organization, DMA, CPU organization, ALU Design, Control Unit & Processor Unit Organization.

**Suggested Readings:**

1. William Stalling, "**Computer Organization & Architecture**". Pearson education Asia
2. Mano Morris, "**Computer System Architecture**", PHI
3. Zaky & Hamacher, "**Computer Orgaization**", Mc Graw Hill
4. B. Ram, "**Computer Fundamentals Architecture & Organization**", New Age Publication
5. Tannenbaum, "**Structured Computer Organization**", PHI
6. V. Rajaraman, "**Fundamentals of Computers**", PHI
7. Peter Norton's, "**Introduction to Computers**", TMH
8. Hahn, "**The Internet Complete Reference**", TMH
9. Hwang and Briggs, "**Computer Architecture and Parallel Processing**", Mc Graw Hill

**MCA-102**      **Discrete Structure (3-1-0)**

**Credit-06**

**(Contract Hours: 45)**

**UNIT-I**

**Relation:** Type and Composition of relations, Pictorial Representation of Relations, Closures of Relations, Equivalence Relations, Partial Ordering Relation Posets, Hasse Diagram..

**Lattices:** Introduction, Ordered set, Hasse Diagram of partially ordered Set, Consistent Enumeration, Isomorphic Ordered Set, Well Ordered Set, Lattices, Properties of Lattices, Bounded Lattices, Distributive Lattices and Complemented Lattices.

**Function:** Type, Composition of Function, Recursively Defined Function.

**Mathematical Induction:** Piano's Axioms, Mathematical Induction, Discrete Numeric Functions and Generating Functions, Simple Recurrence Relation with Constant Coefficients, Linear Recurrence Relation without Constant Coefficient, Asymptotic Behavior of Functions.

## UNIT-II

**Propositional Logic:** First Order Logic, Basic Logical Operations, Tautologies, Contradictions, Algebra of Proposition, Logical Implication, Logical equivalence, Normal Forms, Inference Theory, Predicates and quantifiers.

**Algebraic Structure:** Properties, Semi Group, Monoid Group, Abelian Group, Properties of Group, Sub-Group, Cyclic Group, Cosets, Permutation Groups, Homomorphism, Isomorphism and Automorphism of Groups.

## UNIT-III

Introduction to defining Language, Kleene Closure, Arithmetic Expressions, Chomsky Hierarchy, Regular Expression, Generalized Transition Graph, Conversion of regular Expression to finite Automata, NFA, DFA, Conversion of NFA TO DFA, Optimizing a DGA, FA with output: Moore Machine, Mealy Machine Conversions.

## UNIT-IV

Non-regular Language: Pumping Lemma, Myhill Nerode Theorem, Pushdown Automata, Introduction to Turing Machine and Its Elementary Application to Recognition of a Language and Computation of Function.

### Suggested Readings

1. Liptschütz, Seymour, "Discrete Mathematics", TMH
2. Trembley, J.P & R Manobar, "Discrete Mathematical Structure with Application to Computer Science", TMH.
3. Kenneth H. Rosen, "Discrete Mathematics and its Application", TMH
4. Doerr Alan & Levasseur Kenneth, "Applied Discrete Structures for Computer Science", Galgotia Pub. Pvt. Ltd.
5. Gersting, "Mathematical Structure for Computer Science", WH Freeman & Macmillan
6. Hopcroft J.E. Ullman J.D., "Introduction to Automata Theory Languages and Computation", Narosa Publishing House, New Delhi.
7. C.L.Liu. "Elements of Discrete Mathematics", Mc Graw Hill".

## MCA-103 Object Oriented Programming & C++(3-1-0)

Credit-06  
(Contact Hours: 45)

### UNIT-I

Object & Classes, Links and Associations Generalization and Inheritance, Aggregation, Abstract Classes, A sample Object Model, Multiple Inheritance, Meta Data, Candidate Keys, Constraints.

### UNIT-II

**Dynamic Modeling:** Event and States, Operations and Methods, Nested State, Diagrams, Concurrency, Relation of Object and Dynamic Models, Advanced Dynamic Model Concepts Keys, Constraints.

**Functional Modeling:** Functional Models, Data Flow Diagrams, Specifying Operations, Constraints, a Sample Functional Model.

### UNIT-III

**Programming in C++:** Classes and Objects in C++, Functions, Constructors, Inheritance, Function Overloading, Operator Overloading, I/O Operations, Real Life Applications, Extended Classes Pointer, Virtual Functions, Polymorphisms, Working with files, Class Templates, Function Templates.

### UNIT-IV

Translating Object Oriented Design into an Implementation, OMT Methodologies, Examples and Case Studies to Demonstrate Methodology, Comparison of Methodology, SA/SD and JSD.

### **Suggested Readings:**

1. Rambaugh James et al, "Object Oriented Design and Modeling", PHI-1997
2. Bjarne Stroustrup, "C++ Programming Language", Addison Wesley
3. Balagurusamy E. "Object Oriented Programming with C++", TMH, 2001
4. Booch Grady, "Object Oriented Analysis and Design with Application 3/e", Pearson
5. Lipman, Stanley B, Jonsce Lajole, "C++ Primer Reading", AWL-1999
6. Dillon and Lee, "Object Oriented Conceptual Modeling", New Delhi PHI-1993
7. Stephen R. Shah, "Introduction to Object Oriented Analysis and Design", TMH
8. Berzin Joseph, "Data Abstraction; The Object Oriented Approach Using C++", Mc Graw Hill

**MCA-104 Computer Based Numerical & Statistical Techniques(2-1-0)**

**Credit-03**

**(Contact Hours: 30)**

#### **UNIT-I**

Floating Point Computation, Floating Point Numbers, Machine Epsilon, Sensitivity of Problem and Instability of Certain Algorithms, Errors and Their Propagation in Numerical Computation, Concepts of Convergence and Stability of Algorithm.

#### **UNIT-II**

Roots of Algebraic Equation, Interpolation and Approximations, Interpolating Polynomials and its Construction using Lagrangian Method and Method of Divided Differences. Integrated Interpolation Inverse Interpolation.

#### **UNIT-III**

Newton and Gaussian Quadrature Method. Integration Formulate Using Finite Differences, Romberg Integration, Direct Solution of Linear System, Linear System for Stored Matrices. Condition of the Matrix, Large Sparse Systems, Gauss Elimination, Triangular Decomposition, Eigen Values and Eigen Vectors, Singular Decomposition, Solutions to Ordinary differential Equations- Taylor Series, Euler Method, Modified Euler Method. Runge Kutta Method.

#### **UNIT-IV**

Measure of Central Tendency and Dispersion, Linear Regression, Least Square Method, Rank Correlation Coefficient of Correlation Ratio, Concepts of Population and Sample Parameter & Statistic, Testing of Hypothesis, Chi Square F-t-test, Implementation of Methods in C++

### **Suggested Readings:**

1. Rajaraman V, "Computer Oriented Numerical Methods", PHI
2. Gerald & Wheatley, "Applied Numerical Analyses", AV.
3. Jain, Iyengar and Jain, "Numerical Methods for Scientific and Engineering Computations", New Age Int.
4. Grewal B.S., "Numerical Methods in Engineering and Science", Khanna Publishers, Delhi.
5. T. Veerarajan, T. Ramachandran, "Theory and Problems in Numerical Methods", TMH
6. Pradip Niyodi, "Numerical Analysis and Algorithms", TMH
7. Francis Scheld, "Numerical Analysis", TMH.

**MCA-105 Programming Lab-I (0-0-4)**

**Credit-03**

**(Contact Hours: 30)**

### **Semester-II**

**MCA-201 Graph Theory and Combinatorics (3-1-0)**

**Credit-06**

**(Contact Hours: 45)**

### **NIT-I**

Counting principal, Permutation, Combination, Recurrence Relation, Solution of Recurrence Relation, Inclusion and Exclusion Principal, Introduction of Graph, Types of Graph, Self Loop, Parallel Edge, Adjacent Vertices, Degree, Isolated Vertex, Pendant Vertex, Sub Graph, Walk, Path, Circuit.

### **UNIT-II**

Representation of Graph, Adjacency Matrix, Incidence Matrix, Path Matrix, Euler Graph, Hamiltonian Graph, Traveling Sales Man Problem, Connected Graph, Loosely Connected and Tightly Connected Graph

### **UNIT-III**

Tree, Traversal in a Tree, Types of Tree, AVL Tree, Diameter, Centre, Eccentricity in the Tree, Binary Search Tree, Expression Tree, Spanning Tree, Minimum Cost Spanning Tree, Kruskal Algorithm, Prim's Algorithm, Shortest Path, Dijkstra Algorithm, Path between All Vertex, Depth First Search, Breadth First Search.

### **UNIT-IV**

Coloring of the Graph, Chromatic Number, Chromatic Polynomial, Planar Graph, Kuratowski's Two Non Planar Graph, Kuratowski's Theorem, Dual Graph, Geometric Dual & Combinational Dual, Network Flow, Cut Set, Maximum Flow.

### **Suggested Readings:**

1. Deo Narsingh, "Graph Theory with application to engineering and computer science".
2. Tremblay and Manohar, "Discrete mathematical structure with application to computer".
3. G.L. Goodare, "Discrete mathematics and graph Theory".

**MCA-202      System Programming(3-1-0)**

**Credit-06  
(Contact Hours: 45)**

### **UNIT-I**

Components of System Software, Evolution of System Software, General Machine Structure (Memory, Register, Data Instructions), Assemblers, Design of Two Pass Assembler, Introduction to Macros and Macro Processors.

### **UNIT-II**

Translators, Interpreters, Brief Description of Different Phases of Computer, Loaders: A Two Pass Loaders Scheme, Relocating Scheme, Relocating Loader, Subroutine Linkage, Direct Linking Loader, Binders, Overlays, Types and Basic Functions of Operating Systems.

### **UNIT-III**

Software Tool: Text Editors, Program Generators, Debug Monitors, Access to System Services, ROM, BIOS, Booting Process (DOS), Expanded memories introduction to Mouse, Keyboard & Screen Management.

### **UNIT-IV**

Introduction to DOS Device Drivers: Types, Structure & Processing, Interrupt Types, Organization, Interrupt Hardware and Program Status Register (PSR), Interrupt Processing

### **Suggested Readings:**

1. J.J. Donovan, "System Programming", TMH
2. D.M. Dham Dhere, "Introduction to System Software", TMH
3. D.L. Peter, "An Introduction to Real Time Microcomputer System Design", TMH



4. Ted. J. Biggerstaff, "System Software Tools", Prentice Hall  
Ray Dunkan, "Advanced MS DOS Programming", BPB Publication  
6. D.A. Norton, "System Programming & Operating System", Addison Wesley

**MCA-203 Data Structure (3-1-0)**

**Credit-06**

**(Contact Hours: 45)**

**UNIT-I**

Introduction to Data Structure, Types and operations, Algorithm, Way of Writing Algorithm, Complexity, Memory Allocation of all the data structure. Array, Operations in the Array, Merging of two list, Sorting and Searching - Bubble, Insertion, selection, Quick, Shell, Sorting Networks, Sorting on Disk Files. Search - Linear and Binary Search..

**UNIT-II**

Linked List- Single and Double linked list, Creation, Insertion and Deletion Operation. Polynomial Addition Using Linked List, Queue, Circular Queue, Priority Queue, Stack, Implementation using array and Linked list. Infix to Prefix Representation using Stack and Value of Infix Expression Using Stack. Hash table, Collision in Hash Table. Collision Resolution Technique.

**UNIT-III**

Trees: Linear Tree, Binary Tree and their Representation. Implementation recursively and iteratively, Searching, Traversal (in order, Preorder, Post order). Deletion from tree, Threaded Tree, AVL Tree, Forests, Practical Application.

**UNIT-IV**

Graph: Introduction of Graph, Memory representation of graph using array and linked list, Traversal in graph, Breadth first search and depth first search. Shortest Path Matrix of the graph. Applications of Graph. All implementation using C++.

**Suggested Readings:**

1. Hadley, G., "Linear Programming and Massachusetts", Addison-Wesley
2. Taha, H.A., "Operations Research-An Introduction", Macmillan
3. Hillier, F.S., G.J. Lieberman, "Introduction to Operations Research", Holden-Day
4. Harvey M. Wagner, "Principles of Operations Research with Applications to Managerial Decisions", Prentice Hall of India Pvt.Ltd.
5. Sanjay Pahuja, "Practical Approach to Data structures and Algorithms", New Age International Publishers
6. Schaum's Series, "Introduction of Data Structure", Prentice Hall of India.

**MCA-204 Computer Based Optimization Techniques(2-1-0)**

**Credit-03**

**(Contact Hours:30)**

**UNIT-I**

Linear Programming-Graphical, Simplex, Two Phase & Big M Methods, Dual Linear Programming-Dual of a Problem, Dual Simplex Method.

**UNIT-II**

Transportation Methods- North West Corner, Least Cost, VAM Methods, Optimal Solution by Modi & Stepping Stone Method, Assignment Problem

### **UNIT-III**

Queuing Theory, Inventory Control- EOQ, Price Break , Production Inventory Model, Lead Time, Inventory Control System, Inventory Models, Network Analysis-Time Estimation, PERT and CPM, Statistical Quality Control.

### **UNIT-IV**

Game Theory, Integer and Dynamic Programming, Quadratic Programming, Goal Theory, Simulation and Forecasting Techniques, Implementation in C++

#### **Suggested Readings:**

- 1.Hadley, G., "**Linear Programming and Massachusetts**", Addison-Wesley
- 2.Taha, H.A, "**Operations Research-An Introductin**", Macmillian
3. Hillier, F.S., G.J. Lieberman, "**Introduction to Operations Research**", Holden-Day
- 4.Harvey M. Wagner, "**Principles of Operations Research with Applications to Managerial Decisions**".
- 5.Swarup K. et.al. , "**Operation Research**", S. Chand Pub.

**MCA-205      Programming Lab-II (0-0-4)**

**Credit-03  
(Contact Hours: 30)**

## **SECOND YEAR** **Semester-III**

**MCA-301      Operating System(3-1-0)**

**Credit-06  
(Contact Hours: 45)**

### **UNIT-I**

Basic Concepts and Functions of Operating Systems, Types: Single and Multi User, Batch Processing, Real Time, Time Sharing, parallel and Distributed OS.

Memory Management – Objectives, Classification of Memory Management, Static and Dynamic Memories, allocation techniques, Compaction, Paging & Segmentation, Address Translation, Fragmentation in Each Case, Performance and Comparison.

### **UNIT-II**

Virtual Memories- Aims and Methods of Implementation-static & dynamic, Demand Paging, Page Faults and System Performance, Page Replacement Algorithms, Prepaging, Comparisons.  
Information Management, Files and File System, File System Characteristics, Access and Allocation Methods, Disk Management, Disk scheduling I/O operations.

### **UNIT-III**

Process Management – Process States, State Diagram, Scheduler, Scheduling Algorithms, Deadlock – Necessary Conditions, Prevention, Avoidance, Detection and Recovery, Synchronization of Process.

### **UNIT-IV**

Process Synchronization: Concurrency, Critical Section and Its S/W, H/W and Semaphore Solution, Classical Examples on Semaphore,

**UNIX case study-** Overview –History, flavours and architecture, Unix File system, Basic Commands & Utilities, introduction to shell Programming, & System Calls.

### **Suggested Readings:**

1. Abraham Siberschatz and Peter Baer Galvin, "Operating System Concepts", Fifth Edition, Addison-Wesley.
2. Milan Milankovic, "Operating System, Concepts and Design", Mc Graw-Hill
3. Harvey M Deital, "Operating System", Addison-Wesley.
4. Richard Peterson, "Linux: The Complete Reference", Osborne Mc Graw-Hill
5. Parata, "Advanced Unix Programming Guide", BPB
6. Yashwant Kanitkar, "Unix Shell Programming", BPB
7. Meeta Gandhi, Tilak Shetty, Rajiv Shah, "The 'C' Odyssey Unix-The Open Boundless C", BPB
8. Sumitabh Das, "Unix Concepts and Applications", TMH.

**MCA-302      Analysis & Design of Algorithms(3-1-0)**

**Credit-06  
(Contact Hours: 45)**

### **UNIT-I**

**Introduction:** Algorithms, Analysis of Algorithms, Design of Algorithms and complexity of Algorithms, Asymptotic Notations, Growth of Function, Recurrences Sorting in Polynomial Time: Insertion Sort, Merge Sort, Heap Sort and Quick Sort, Sorting in Linear Time: Counting Sort, Radix Sort, Bucket Sort, Medians and order Statistics.

### **UNIT-II**

**Elementary Data Structure:** Stacks, Queues, Linked List, Binary Search Tree, Hash Table.

**Advanced Data Structure:** Red Black Trees, Splay Trees, Augmenting Data Structure Binomial Heap, B Trees, Fibonacci Heap and Data Structure for Disjoint Sets Union-find Algorithm, Dictionaries and Priority Queues, Merge able Heaps, Concatenable queues.

### **UNIT-III**

**Advanced Design and Analysis Techniques:** Dynamic Programming, Greedy Algorithm, Backtracking, Branch and Bound, Amortized Analysis.

**Graph Algorithms:** Elementary Graph Algorithms, Breadth First Search, Depth First Search, Minimum Spanning Tree, Kruskal's Algorithms, Prim's Algorithms, Single Source Shortest Path, All Pair Shortest Path, Maximum Flow and Traveling Salesman Problem.

### **UNIT-IV**

Randomized Algorithms, String Matching, NP-Hard and NP-Completeness Approximation Algorithms, Sorting Network, Matrix Operations, Polynomials & The FFT, Number Theoretic Algorithms, Computational Geometry, Implementation in C++

### **Suggested Readings:**

1. Horowitz Sahani, "Fundamentals of Computer Algorithms", Goltotia
2. Coremen Leiserson et.al., "Introduction to Algorithms", PHI
3. Brassard bratley, "Fundamental of Algorithms", PHI
4. M.T. Goodrich et.al., "Algorithms Design", John Wiley
5. A.V. Aho et.al., "The Design and Analysis of Algorithms", Pearson Education

**MCA- 303    Software Engineering (3-1-0)**

**Credit-06  
(Contact Hours: 45)**

### **UNIT-I**

**Introduction:** Introduction to software engineering, Importance of software, The evolving role of software, Software Characteristic, Software Components, Software Application, Software Crisis. Software engineering problems, Software Development Life Cycle, Software Process.

#### **UNIT-II**

**Software Requirement Specification:** Analysis Principles, Water Fall Model, The Incremental Model, Prototyping, spiral Model, Role of Management in software Development, Role of matrices and measurement, Problem Analysis, requirement Specification, Monitoring and control.

**Software-Design:** Design principles, Problem partitioning, Abstractin, Top down and bottom up-design, Structured approach, Functional versus object oriented approach, desing specifications and verification, Monitoring and control, Cohesivenessd, coupling, Forth generation techniques, Functional independence, software Architecture, Transaction and Transform Mapping, Component-Level Design, Forth Generation Techniques.

#### **UNIT-III**

**Coding:** Top-down and Bottom-Up Programming, Structured Programming, Information hiding, Programming style and internal documentation.

**Testing:** Testing Principles, Levels of testing, functional testing, Structural testing, test plane, test case specification, reliability assessment, software testing strategies, Verification & validation, unit testing, Integration Testing, Alpha & Beta Testing, System Testing and Debugging.

**Software Project Management:** The Management Spectrum(The people, the product, the process, the project), Cost estimation, Project Scheduling, staffing, software configuration management, Structured Vs. Unstructured maintenance, quality assurance, Project monitoring risk management.

#### **UNIT-IV**

**Software Reliability & Quality Assurance:** Reliability issues, Reliability metrics, Reliability growth modeling, Software quality, ISO 9000 Certification for software industry. SEI Capability maturity model, Comparison between ISO & SEI CMM.

CASE (Computer Aided Software Engineering): CASE and its scope, CASE support in software life cycle, documentation, project management, internal interface, Reverse software engineering, Architecture of CASE environment.

#### **Suggested Readings:**

- 1.Pressman, Roger S, "**Software Engineering**", A Practitioner's Approach Ed. Boston: Mc Graw Hill, 2001
- 2.Jalote, Pankaj, "**Software Engineering Ed.2**", New Delhi: Narosa2002
- 3.Schaum's Series, "**Software Engineering**", TMH
- 4.Ghezzi, Carlo and Others, "**Fundamentals of Software Enigneering**", PHI
- 5.Alexis, Leon and Mathews Leon, "**Fundamental of Software Engineering**", Vikas
- 6.Sommerville, Ian, "**Software Engineering**", AWL, 2000

**MCA-304      Internet and Java Programming (2-1-0)**

**Credit-03  
(Contact Hours: 30)**

#### **UNIT-I**

**Internet:** Connecting to Internet Telephone, Cable, Satellite Connection, Choosing an ISP, Introduction to Internet Services, E-Mail Concepts, Sending and Receiving secure E-Mail, Voice and Video Conferencing.

#### **UNIT-II**

**Core Java:** Introduction, Operator, Data type, Variable, Arrays, Control Statements, Methods & Classes, Inheritance, Package and Interface, Exception Handling, Multithread Programming, I/O, Java Applet, String

Handling, Networking, Event Handling, Introduction to AWT, AWT controls, Layout managers, Menus, Images, Graphics.

### UNIT-III

**Java Swing:** Creating a Swing Applet and Application, Programming using Panes, Pluggable Look and feel, Labels, Text fields, Buttons, Toggle Buttons, Check boxes, Radio Buttons, View Ports, Scroll Panes, Scroll Bars, Lists, Combo Box, Progress Bar, Menus and Toolbars, Layered Panes, Tabbed Panes, Split Panes, Layouts, Windows, Dialog Boxes, Inner, Frame, JDBC: The connectivity Model, JDBC/ODBC Bridge, Java.sql Package, connectivity to remote database, navigating through multiple rows retrieved from a database.

### UNIT-IV

**Java Beans:** Application Builder tools, The bean develop, kit(BDK), JAR files, Introspection, Developing a simple bean, using Bound properties, The Java Beans API, Session Beans, Entity Beans, Introduction to Enterprise Java Beans (EJB), Introduction to RMI (Remote Method Invocation): A Single client-server application using RMI.

**Java Servlets :** Servlet basics, Servlet API basic, Life cycle of a Servlet, Running Servlet, Debugging Servlets, Thread-safe Servlets, HTTP Redirects, Cookies, Introduction to Java Server pages(JSP).

#### Suggested Readings:

1. John Zukowski, Mastering Java
2. Evangelos P., MasteringVB6
3. Deborah, S., Roy & Eric Roy, Mastering HTML
4. Deital & Deital, Java How to Program
5. A. Russel, Mastering ASP, BPB Publication
6. Ann Navarro, Mastering XML, BPB Publication
7. W.Boggs & M.Boggs, Mastering UML with Rational Rose, BPB Publication

**MCA-305      Programming Lab III (0-0-4)**

**Credit-03**

**(Contact Hours: 30)**

#### **Includes**

(i) Lab Practice on MCA-301/304 (ii) Seminar-on emerging & contemporary topics (2Hrs./Week)

### Semester-IV

**MCA-401      Data Base Management System (3-1-0)**

**Credit-06**

**(Contact Hours: 45)**

#### **UNIT-I**

**Introduction:** An overview of database management system, Database system Vs File System, Database system concepts and architecture, Data models schema and instances, Data independence and Data base language and interfaces, Data Definitions Language, DML, Overall Database Structure.

**Data modeling using the Entity Relationship Model:** ER model concepts, notation for ER diagram, mapping constraints, keys, Concepts of Super Key, Candidate Key, Primary Key, Generalization, aggregation, reduction of an ER diagrams to tables, extended ER model, relationships of higher degree.

#### **UNIT-II**

**Relational Data Model and Language:** Relational data model concepts, integrity constraints: entity integrity, referential integrity, Keys constraints Domain constraints, relational algebra, relational calculus, tuple and domain calculus.

**Introduction to SQL:** Characteristics of SQL, Advantages of SQL, SQL data types and literals, Types of SQL Commands, SQL operators and their procedure, Tables, Views and Indexes, Queries and Sub Queries, Aggregate Functions, Insert, update and delete operations, Joins, Unions, Intersection, Minus, Cursors in SQL, PL/SQL, Triggers and Clusters.

### UNIT-III

**Data Base Design and Normalization:** Functional dependencies, normal forms, first, second, third normal forms, BCNF, Inclusion dependencies, loss less join decompositions, normalization using FD, MVD and JDs, alternative approaches to database design.

**Transaction Processing Concepts:** Transaction system, Testing of serializability, Serializability of schedules, conflict & view serializable schedule, Recoverability, Recovery from transaction failures, log based recovery, checkpoints, deadlock handling.

### UNIT-IV

**Concurrency Control Techniques:** Concurrency control, Locking Techniques for concurrency control, Time stamping protocols for concurrency control, validation based protocol, multiple granularity, Multiversion schemes, Recovery with concurrent transaction. Transaction Processing in Distributed system, data fragmentation, Replication and allocation techniques for distributed system, overview of concurrency control and recovery in distributed database.

### Suggested Readings:

1. Date C.J., "An Introduction to Database System", Addison Wesley
2. Korth, Silbertz, Sudarshan, "Database Concepts", Mc Graw Hill
3. Elmasri, Navathe, "Fundamentals of Database System", Addison Wesley
4. Paul Beynon Davies, "Database System", Palgrave Macmillan
5. Bipin C. Desai, "An Introduction to Database System", Galgotia Publication
6. Majumdar & Bhattacharya, "Database Management System", TMH
7. Ramakrishnan, Gehrke, "Database Management System", Mc Graw Hill
8. Bharti P.K., "An Introduction to Database Systems", JPNP

**MCA-402      Compiler Design (3-1-0)**

**Credit-06  
(Contact Hours: 45)**

### UNIT-I

Introduction of Compilers and Translators, Phases of compiler, Regular expressions, Finite State Machines, Push Down Machines and Their Application, tokens, Lexical analysis, Symbol Tables Organization, Introduction to Lexical Analyzer.

### UNIT-II

Syntax Analysis: Grammars, Ambiguity, Classification, Parsers-Top Down and Bottom Up, Operator Precedence, Recursive Descent Parser, LL(I) Grammar, Error Handling, Shift Reduce Processing, LR Grammars and Parsers, Their Application.

### UNIT-III

Intermediate Codes: Internal Forms of Source Program, Semantic Analysis, Intermediate Code Forms, Syntax Directed Translations for assignment, mixed statements, arrays references and function.

### UNIT-IV

Code Optimization: Types, Local, Loop Optimization, basic blocks construction, Use of Data Flow Analysis in code optimization.

Code Generation: Features and Problems in Code Generation, Code Generation Through GETREG, DAG.

### **Suggested Readings:**

1. Aho & Ulman, Principles of Compiler Design, Narosa Publication
2. Aho & Sethi, Ulman, Compilers: Principles, Techniques & Tools, Addison Wesley
3. Barrat, Eates, et.al. Compiler Construction: Theory & Practice, Galgotia Publication
4. Trembley & Sorenson, Compiler Writing, TMH
5. Allen I Holub, Compiler Design in C, PHI
6. Gries, Compiler Construction for Digital Computer, Johi, Wiley & Sons.

### **MCA-403 Data Communication and Computer Networks (3-1-0)**

**Credit-06**

**(Contact Hours: 45)**

#### **UNIT-I**

Digital Communication, Fundamentals of Digital Communication, Communication Channel, Measure of Information, Encoding of Source Output, Shannon's Algorithms, Discrete and Continuous Channel Entropy, Variable Length Code.

#### **UNIT-II**

Data Compression Shannon's Theorem, Transmitter, Channel Noise, Amplitude Modulation, Frequency Modulation, Sampling, Pulse Modulation, PWM, PDM, PPM, PCM.

Compression & Codes, Scheme Coherent and Non Coherent Detector, Probability of Error.(Pre).

Performance Analysis and Compression, Error Detection and Correction Codes.

#### **UNIT-III**

Goals and Application of Networks, Networks Structure and architecture, the OSI reference model, services, networks topology, Physical Layer-transmission, switching methods, Integrated services digital networks, terminal handling.

**Medium access sub layer:** Channel allocations, LAN protocols, ALOHA Protocols-Pure ALOHA, slotted ALOHA, Carrier Sense Multiple Access Protocols, CSMA with Collision free Protocols, IEEE Standards, FDDI, Data Link Layer-elementary data link protocols, sliding windows protocols, error handling, high Level Data Link Control.

#### **UNIT-IV**

**Network Layer:** Point-to Point networks, routing algorithms, congestion control algorithms, Internetworking, TCP/IP packet and IP addresses, IPv6.

**Transport Layer:** Design issues, connection management, TCP window Management, User Datagram Protocol, Transmission Control Protocol.

**Application Layer:** Network Security DES, RSA algorithms, Domain Name System, Simple Network Management Protocol, Electronic mail, File Transfer Protocol, Hyper Text Transfer Protocol, Cryptography and Compression Techniques.

### **Suggested Readings:**

1. A.S. Tanenbaum, "Computer Networks, 3<sup>rd</sup> Edition", PHI
2. W. Stallings, "Data and Computer Communication", Macmillan Press
3. Comer, "Computer Networks & Internet", PHI
4. Comer, "Internetworking with TCP/IP", PHI

5. Forouzan, "Data Communication and Networking", TMH

MCA-404 Elective Paper

Credit-03

(Contact Hours: 30)

MCA-405 Programming Lab IV (0-0-4)

Credit-03

(Contact Hours: 30)

Includes: (i) LAB Practice on 401 (ii) Development of Mini Project (2 hrs/week)

**THIRD YEAR**  
**Semester-V**

MCA-501 Artificial Intelligence (3-1-0)

Credit-06

(Contact Hours: 45)

**UNIT-I**

**Artificial Intelligence:** Definition, Historical Overview, Growth, Turing Test and Its Significance Branches of AI and Applications, Problem Solving, production system and Control Strategies.

**UNIT-II**

**State Searching:** Informed and Uninformed (blind) Searches-DFS, BFS, Best First Search etc. AND-OR Graph, Algorithms A\*, Properties of A\*, AO\* and Related Algorithms, Game Playing Strategies, Mini Max Procedure and Applications.

**UNIT-III**

**Knowledge Representation:** Propositional Logic, First Order Predicate, Semantic Net, Partitioned Semantic Net, Frames and Scripts, Conceptual Dependency (CD), Reasoning Process, Uncertainty Considerations.

Introduction to Expert Systems: System Feasibility Considerations, Architecture, Tools Overview of Rule Based and Other Types of ES Design.

**UNIT-IV**

**Natural Language Processing:** Grammar for Natural Languages, Parsing, Transition Nets (TN), ATN and RTN Parser, Lexicon, Sentence Generation.

**Introduction to:** Pattern Recognition, Planning, Machine Translation, Neural Nets and Machine Learning, Fuzzy Logic.

**Suggested Readings:**

1. Elaine, Rich & K. Knight, Artificial Intelligence, TMH Publication
2. N.J. Nilson, Principles of Artificial Intelligence, Narosa Publication
3. Russell & Norvig, Artificial Intelligence: A modern Approach, Pearson Education, 2013
4. E.Charniak & D. Mc Dermott, Introduction to AI, Addison Wesley
5. Avron Barr & Edward A, Feigenbaum the Handbook of Artificial Intelligence, Addison Wesley-Longman
6. James Allen, Natural Language Understanding, Pearson.
7. Peter Jackson, Introduction to Experts System, Addison Wesley
8. Tau & Genzales, pattern Recognition Principles, Addison Wesley.

MCA-502 Computer Graphics (3-1-0)

Credit-06



**UNIT-I**

Graphics Display Devices, Interactive Devices, Line and Circle Plotting Using Bresenham's Algorithm Windowing and Clipping, Sutherland Cohen Approach, Curus Back Method, Midpoint Subdivision Algorithm, Curve Drawing, Hermit Polynomial.

**UNIT-II**

Bezier Curves, B-Splines, Picture Transformation, Scaling Mirror Images, 2D & 3D Graphics, Coordinate System, 3D Transformation, Rotation about an Arbitrary Axis.

**UNIT-III**

Orthogonal Projection, Multiple Views, Isometric Projections, Perspective projections, 3D Clipping, Hidden Surface Removal, Curved Surface Generation, Generation of Solids, Sweeps Method, Interpolation, Illumination model, Ray Tracing.

**UNIT-IV**

Shading, Transparency, Shadows, Textures Colors, CGS Modelling, Graphic Standards GKS, PHIGS, Animation Fundamentals-Control and Sequencing, Creating, Sealing and Saving Frames, Synchronising Frames, Audio-Video Editing, Implementation in C++.

**Suggested Readings:**

1. Donald Hearn and M. Pauline Baker, "Computer Graphics", PHI
2. Steven Harrington, "Computer Graphics: A Programming Approach", TMH
3. Prajapati A.K., "Computer Graphics", PPM Ed2
4. Foley James D, "Computer Graphics", AW Ed2
5. Newman and Sproul, "Principle of Interactive Computer Graphics", Mc Graw Hill
6. Rogers, "Procedural Elements of Computer Graphics", Mc Graw Hill
7. Rogers and Adams, "Mathematical Elements of Computer Graphics", Mc Graw Hill

<b>MCA-503</b>	<b>Elective (3-1-0)</b>	<b>Credit-06</b> <b>(Contact Hours: 45)</b>
<b>MCA-504</b>	<b>Elective (2-1-0)</b>	<b>Credit-03</b> <b>(Contact Hours: 30)</b>
<b>MCA-505</b>	<b>Software Lab V (0-0-4)</b>	<b>Credit-03</b> <b>(Contact Hours: 30)</b>
<b>Includes</b> (i). Lab Practice on MCA-502		

**Semester VI**

<b>MCA-601</b>	<b>Industrial Training and Project</b>	<b>24 Credits</b>
	(I) Internal assessment	30% weighrage
	(II) External Assessment (Dissertation & Viva-voce examination	70% weighrage

**A) List of Electives for Semester IV (Elective-D):-**

1. Modeling & Simulation
2. Data Mining
3. Real Time System
4. Software Project Management
5. Electronic Commerce
6. Parallel Computing

**B) List of Electives for Semester IV (Elective-II & III):-**

**(i) Electives II (6 Credit)**

1. Distributed Computing
2. Embedded Systems
3. Soft Computing
4. Digital Image Processing

**(ii) Electives III (3 Credit)**

1. Advance Database Management System
2. Neural Network
3. Natural Language Processing
4. Digital Signal Processing
5. Mobile Computing

**For Semester IV (Elective-I):-**

**1. Modeling & Simulation (2-1-0)**

**Credit 3**

**(Contact Hours: 30)**

**UNIT-I**

System Definition and Components, Stochastic Activities, Continuous and Discrete Systems, System Modeling, Types of Model, Static and Dynamic Physical Models, Static and Dynamic Mathematical Models, Full Corporate Model, Types of System Study.

**UNIT-II**

System Simulation, Why to Simulate and When to Simulate, Basic Nature of Simulation, Technique of Simulation, Comparison of Simulation and Analytical Methods, Types of System Simulation, Real Time simulation, Hybrid Simulation, Simulation of Pure-Pursuit Problem Single-Server Queuing System and An Inventory Problem, Monte Carlo Simulation, Distributed Lag Models, Cobweb Model.

**UNIT-III**

Simulation of Continuous Systems, Analog Vs, Digital Simulation, Simulation of Water Reservoir System, Simulation of A Servo System, Simulation of An Autopilot Discrete System Simulation, Fixed Time-Step Vs, Event-To-Event Model, Generation of Random Numbers, Test for Randomness, Generalization of Non-Uniformly Distributed Random Numbers, Monte-Carlo Computation Vs. Stochastic Simulation.

**UNIT-IV**

System Dynamics, Exponential Growth Models, Exponential Decay Models, Modified Exponential Growth Models, Logistic Curves, Generalization of Growth Models, System Dynamics Diagrams, Feedback in Socio-Economic Systems.

**Suggested Readings:**

1. Geoffrey Gordon, "System Simulation", PHI
2. Narsingh Deo, "System Simulation with Digital Computer", PHI
3. Averill M. Law, W. David Kelton, "Simulation Modeling and Analysis", TMH

**2. Data Mining (2-1-0)**

**UNIT-I**

The process of knowledge discovery in databases, predictive and descriptive data mining techniques, supervised and unsupervised learning techniques

**UNIT-II**

Introduction to DATA warehousing, Data-Mart, Client/Server Computing Model & Data Warehousing, On Line Analytical Processing (OLAP)

**UNIT-III**

**Techniques of Data Mining:** Link analysis, Predictive Modeling, Database Segmentation, Decision Trees, Bayesian techniques in data mining. Nearest Neighbor & Clustering, Rule Introduction

**UNIT-IV**

Introduction to Multimedia Data-Mining, Mining the World Wide Web (Web Data-Mining), Search engines, Web query expansion, Mining Meta-Data, Data Visualization & Overall Perspective, Application of Data-Mining.

**UNIT IV**

**Issues in Data Mining:** Scalability and data management issues in data mining algorithms, privacy, social, ethical issues in KDD and data mining, pitfalls of KDD and data mining

**Suggested Readings:**

1. Jiawei Han and Micheline Kamber, **Data Mining: Concepts and Techniques** (2nd ed.), Morgan Kaufmann, 2006.
2. Berson, "**Data Warehousing, Data-Mining & OLAP**", TMH
3. Mallach, "**Decision Support and Data Warehousing System**", TMH
4. Bhavani Thuraisingham, "**Data-Mining Technologies, Techniques Tools & Trends**", CRC Press
5. Margaret H. Dunham, "**Data-Mining, Introductory & Advance Topics**", Pearson Education
6. Pieter Adrians, Dolf Zantinge, "**Data-Mining**", Pearson Education.

**3. Real Time System (2-1-0)**

**UNIT-I**

Introduction To Real-Time Computing: Characterizing Real – Time System & Task; Performance Measures of Real Time System, Estimation of Program Run Time, Real- Time System Design: Hardware Requirement, System Development Cycle.

**UNIT-II**

Data Transfer Techniques, Synchronous & Asynchronous Data Communication, Standard Interface. Task Assignment And Scheduling: Priority Scheduling, Scheduling with Fixed Priority Dynamic Priority Scheduling.

### **UNIT-III**

Real-Time Programming Language & Tool: Desired Language Characteristics, Data Typing, Control Structure, Run Time Error- Handling, Overloading & Generics, Runtime Support, Real-Time Databases.

### **UNIT-IV**

Real-Time Communication Language Algorithm: Fault Tolerance Techniques, Causes of Failure, Fault Type, Fault Detection, Redundancy, Integrated Failure Handling Reliability Evaluation Techniques: Parameter Values, Reliability Model For Hardware Redundancy, Software Error Model, and Clock Synchronization.

#### **Suggested Readings:**

1. Real Time System: by C.M. Krishna & K.G. Shen- Mc Graw Hill 1197.
2. Real Time Microcomputer Design: An Introduction by P.D. Lawrence & K. Mauch, Mc. Graw Hill, 1998.
3. Real Time System: Specification, Verification & analysis by Mathai Joseph, Prentice Hall Inc. 1996.
4. Real Time Computer control by Stuart Bennet, Printice Hall., 1998.
5. Real Time Language by S.J. Young, John willey & sons, 1982.

## **4. Software Project Management (2-1-0)**

### **UNIT-I**

Introduction to Project Management, Importance of Software Project Management, Stages And Stakeholders of a Software Project, Elements of Software Project, Project Planning, Project Execution, Project and Product Life Cycles, Role of Project Manager, Project Management Framework, Software Tools for Project Management

### **UNIT-II**

Importance of Integration Management And Scope Management, Project Plan Development, Plan Execution, Scope Management, Methods for Selecting Projects, Project Scheduling, Schedules And Activities, Sequencing And Scheduling Activity, Project Network Diagrams, Network Planning Models, Program Evaluation And Review Technique (Pert), Project Cost Management, Cocomo Model, Types of Cost Estimates

### **UNIT-III**

Project Quality Management, Quality Assurance, Planning And Control on Projects, Quality of Information Technology Projects, Stages of Software Quality Management, Tools and Techniques for Quality Control, Project Human Resources Management, project Human Resources Management , Keys to managing, Organizational Planning, Issues In Project Staff Acquisition And Tea Development

### **UNIT-IV**

Distributing Project Information and the Advantages and Disadvantages, Project Documentation and the Use of Templates, Project Risk Management, Key Concepts In Risk Response Development, Sources of Risk in it Projects, Project Procurement Management, Project Management Process Groups, Project Controlling and Configuration Management, Project Closing

#### **Suggested Readings:**

1. Kathy Schwabe, "Information Technology Project Management "Kathy Schwabe, International Student Edition,
2. Bob Hughes and Mike Cotterell "Software Project Management", Third Edition, Tata Mcgraw- Hill
3. Elaine marnel, "Microsoft Office Project 2003 Bible", Wiley Publishing Inc.

4. Basics of software Project Management, Niit, Prentice-Hall India, 2004

5. Jalote Pankaj, Software Project Management In Practice, Pearson Education

## **5. ELECTRONIC COMMERCE (2-1-0)**

### **Unit I**

**Building Blocks of Electronic Commerce:** Introduction, internet and networking technologies, Internet and network protocols, web server scalability, software technologies for building E-commerce applications, distributed objects, object request brokers, component technology, web services, web application architectures, BizTalk framework Compliant Server

### **Unit II**

**Security of E-commerce transactions:** Review of cryptographic tools, authentication, signatures, observers, anonymity, privacy, traceability, key certification, management and escrow

### **Unit III**

**Payment protocols and standards:** Smart card, e-cash, e-wallet technologies, electronic money and electronic payment systems, business models for electronic commerce, electronic marketplaces, auctions and other market mechanisms, design of auctions, optimization algorithms for marketplaces, multi-agent systems.

### **Unit IV**

**Global eCommerce and Law:** Cyber law in India. Comparative evaluation of Cyber laws of certain countries.

### **Suggested Readings:**

1. E.M. Awad, **Electronic Commerce From Vision to Fulfillment** (3rd ed.), Prentice-Hall of India, 2006

2. P.T. Joseph, **E-Commerce An Indian Perspective**, Prentice-Hall of India, 2007

3. Scott Bonneau, Tammy Kohl, Jeni Tennison, Jon Duckett and Kevin Williams, **XML Design Handbook**, Wrox Press Ltd., 2003.

4. Michael Cheshar, Ricky Kaura, and Peter Linton, **Electronic Business and Commerce**, Springer, 2003.

5. W.J. Pardi, **XML in Action: Learn to quickly create dynamic, data-driven sites with the Web's hottest new technology**, Prentice Hall of India, 1999.

6. P. Weill and M.R. Vitale, **Place to Space: Migrating to eBusiness Models**, Harvard Business School Press, 2001.

7. D. Whiteley, **eCommerce: Strategy, Technologies and Applicaitons**. Tata McGraw-Hill Edition, 2001.

8. M. Fitzgerald, **Building B2B Applications with XML: A Resource Guide**, John Wiley and Sons, Inc., 2001

## **6. Parallel Computing (2-1-0)**

### **UNIT-I**

Introduction of Parallel Computing, Advantages of Parallel Computing, Solving Problem In Parallel: Temporal Parallelism, Data Parallelism and Their Comparison. Inter Task Dependency And Task Graphs. Structure of Parallel Computers: Pipelined

### **UNIT-II**

Parallel Computers, Array Processors, Shared Memory Multiprocessor, Message Passing Multiprocessors, MMC Systems, Integer Arithmetic; Cary Look- Ahead, Addition And Carry-Save Addition On Binary Tree, Integer Multiplication And Convolution On Linear Array. Elementary Sorting Algorithms.

### **UNIT-III**

Matrix Algorithm: Matrix- Vector Multiplication And Solving Lower Triangular System of Equation On A Linear Array, Matrix, Matrix Multiplication, LU Decomposition, Matrix Inversion, Gaussian Elimination On A Mesh.

Graph Algorithms: Mesh Algorithm for Transitive Closure, Connected Component, Shortest Path, Breadth First Search And Minimum spanning Tree. Mesh of Trees and its Applications Such as Matrix-Vectors Multiplication, Convolution And Integer Multiplication

### **UNIT-IV**

More Fancier Networks: R-Dimensional Mesh of Trees, Shuffle Trees, Shuffle-Exchange Network, Hypercube, De- Bruijn Network And Butterfly. Some Examples on These Networks, Sorting And FFT On Butterfly. Introduction To Dataflow Computers. Parallelism In Logic Programming. Programming Parallel Computers.

#### **Suggested Readings:**

1. Elements of Parallel Processing, V. RajaRaman, Prentice- Hall of India, 1990.
2. Designing efficient Algorithms on parallel Computers, Mc- Graw Hill International, New York, 1987.
3. Parallel Algorithms, Dhall et.al., Mc-Graw Hill In

### **(B) List of Electives for V Semester (Elective II & III)**

#### **(i) Electives II (6 credit)**

#### **1. Distributed Computing (2-1-0)**

##### **UNIT-I**

Distributed Operation System: Distributed Computing System Models, Issues In Design of Distributed Operating System, Message Passing, Remote Procedure Calls, Synchronization, Process Management, Distributed File Systems, Introduction to Distributed Data –Bases

##### **UNIT-II**

Distributed Algorithms: Introduction To Distributed Algorithms, Synchronous and Partial Synchronous Models, Algorithms In General Synchronous Leader Election, Breadth First Search, Shortest Path, Randomized Algorithms

##### **Unit-III**

Distributed Consensus With Link And Process Failures. Asynchronous System Model, I/o Automata, Operation of Automata, Complexity Measures, Randomizations, Asynchronous Shared Memory Model, Mutual Exclusion, Resource Allocation, Consensus.

##### **UNIT-IV**

Asynchronous Network Model, Basic Asynchronous Network Algorithms, Shared Memory Vs Networks. Introduction To Parallel Distributed Processing: General Framework, Methods Of Learning.

#### **Suggested Readings:**

1. PK Sinha, Distributed Operating System, PHI, 1997.
2. AS Tanenbaum, Modern Operating System, PHI.
3. Nancy A Lynch, Distributed Algorithms, Morgan Kaufmann Pub. Inc., 1996.

#### **2. Embedded Systems (2-1-0)**

### **UNIT- I**

Introduction to Embedded systems, Architectural Issues: CISC, RISC, Architectures, Memory, Component Interfacing: Interrupts, DMA, I/O Bus Structure, I/O Devices, OS for Embedded Systems, Real Time Systems & Issues

### **UNIT-II**

Designing of Embedded System: Design Issues, Hardware Software Codesign, Specification Language, USE of UML Design in Embedded System, Modeling Methods of Design, Software Design of Programming Embedded System

### **UNIT-III**

Testing of Embedded System, Coding Techniques, Optimization of Code Techniques, Introduction to VHDL Based PGA Design, Networked Embedded System.

### **Unit-IV**

Distributed Embedded Architectures, Protocol Design Issues, Wireless Network, Introduction to Embedded Multimedia and Telecommunication Application like Digital Camera, Digital TV, etc.

#### **Suggested Readings:**

1. Arnold Berger-Embedded System Design, TMH.
2. Krishna, C.M, "Real Time System", McGraw Hill.
3. D. Gajski et al., Designing of Embedded System by Prentice Hall.
4. Jane W.S. Liu, "Real Time Systems", Pearson Education Asia
5. Kluwer Academic Publisher, Hardware Software Co- Design: Principles & Practice
6. Frank Vahid et al., Embedded System Design, John Wiley & Sons.

### **3. Soft Computing (2-1-0)**

#### **UNIT-I**

Neural Networks: History, overview of biological Neuro-system, mathematical Models of Neurons, ANN architecture, Learning rules, Learning Paradigms- Supervised, Unsupervised and reinforcement Learning, ANN training Algorithms-perceptions, Training rules, Delta, Back Propagation Algorithm, Multilayer Perception Model, Hopfield Networks, Associative Memories, Applications of Artificial Neural Networks.

#### **UNIT-II**

Introduction to Fuzzy Logic, Classical and Fuzzy Sets: Overview of Classical Sets, Membership Function, Fuzzy rule generation on Fuzzy Sets: Compliment, Intersection, Unions, Combinations of Operations, and Aggregation Operations.

#### **UNIT-III**

Fuzzy Numbers, Linguistic Variables, Arithmetic Operations on Intervals & Numbers, Lattice of Fuzzy Numbers, Fuzzy Equations. Fuzzy Logic: Classical Logic, Multivalued Logics, Fuzzy Propositions, Fuzzy Qualifiers, Linguistic Hedges. Uncertainty based Information: Information & Uncertainty, Nonspecificity of Fuzzy & Crisp Sets, and Fuzziness of Fuzzy Sets.

#### **UNIT-IV**

Introduction of Fuzzy image processing, Fuzzy Data Fusion; Fuzzy Diagnosis; Neural Networks: Supervised Learning: Hopfield Nets, Perceptrons, gradient descent, multilayer nets, backpropagation, overfitting. Introduction of Neuro-Fuzzy Systems, Architecture of Neuro Fuzzy Networks. Application of Fuzzy Logic: Medicine, Economics etc. An Overview. GA in problem solving, Implementation of GA

#### **Suggested Readings:**

1. Anderson J.A, "An Introduction to Neural Networks", PHI, 1999.

2. Hertz J. Krogh, R.G. Palmer, "Introduction to the Theory of Neural Computation", Addison-Wesley, California, 1991.
3. G. J. Klir & B. Yuan, "Fuzzy Sets & Fuzzy logic", PHI, 1995.
4. Melanie Mitchell, "An introduction to Genetic Algorithm", PHI, 1998.
5. "Neural Networks- A Comprehensive Foundations", Prentice-Hall International, New Jersey, 1999.
6. Freeman J.A. & D.M. Skapura. "Neural Networks: Algorithms, Applications and Programming Techniques", Addison Wesley, Reading, Mass, (1992).

#### **4. Digital Image Processing (2-1-0)**

##### **UNIT-I**

Why Digital Images; The Digital Camera; Data Types And 2d Representation of Digital Images; Discrete Sampling Model; Quantisation; Noise Processes; Image Attributes Thresholding and Thresholding Algorithms; Performance Evaluation And ROC Analysis;  
 Connected Components Labeling; Region Growing And Region Adjacency Graph (RAG);  
 Split And Merge Algorithms; Grey Level Transformations; Histogram Equalization; Geometric Transformations; Affine Transformation; Polynomial Warps.

##### **UNIT-II**

Erode And Dilate As Max And Min Operators On Binary Images; Open, Close, Thinning And Other Transforms; Medial Axis Transform; Introduction To Grey- Level Morphology; Calculation Of Region Properties; Moment Features; Boundary Coding; Fourier Descriptors Line Descriptors From Boundary Coding And From Moments.

##### **UNIT-III**

Linear And Non-Linear Filtering Operations; Image Convolutions; Separable Convolutions Sub- Sampling And Interpolation As Convolution Operations; Alternative Approaches; Edge Enhancement By Differentiation; Effect of Noise, Edge Detection And Canny; Implementation; Edge Detector Performance Evaluation, Image Structure Tensor;  
 Relationship To Image Auto- Correlation; Characterisation And Harris Corner Detector.

##### **UNIT-IV**

Sub-Pixel Accuracy And Performance Evaluation; Representations of Colour In Digital Images; Colour Metrics; Pixel- Wise (Point) Operations; Colour Invariants And Finlayson Colour Contancy Algorithm similarity and Dissimilarity Matching Metrics; L2 Metric And Relationship To Cross- Correlation; Image Search And Multi- Resolution Algorithms, 2D Object Detection, Recognition, Location

##### **Suggested Reading:**

1. A.K. Jain, Fundamentals of Digital Image Processing, PHI Publication.
3. M.A. Ahmed, Image Processing, TMH.
4. Earl Gose, Richard, Johnsonbaugh, Pattern Recognition & Image Analysis, PHI.

##### ***(ii) Electives III (3 Credit)***

#### **1. Advance Database Management System (2-1-0)**

##### **UNIT-I**

Query Processing, Optimization & Database Tuning: Algorithms for Executing Query Operations. Heuristics for Query Optimization, Estimations of Query Processing Cost, Join Strategies for Parallel Processors, Database Workloads, Tuning Decisions, DBMS Benchmarks, Clustering & Indexing, Multiple Attribute Search Keys, Query Evaluation Plans, Pipelined Evaluations, System Catalogue in RDBMS.



## **UNIT-II**

Extended Relational Model & Object Oriented Database System: New Data Types, User Defined Abstract Data Model, Data Log, Nested Relational Model and Expert Database System.

### **Distributed Database System:**

Structure of Distributed Database, Data Fragmentation, Data Model, Query Processing, Semi Join, Parallel & Pipeline Join, Distributed Query Processing In R \* System, Concurrency Control in Distributed Database System, Recovery In Distributed Database System, Distributed Deadlock Detection And Resolution, Commit Protocols.

## **UNIT-III**

Enhanced Data Model for Advance Application: Database Operating System, Introduction to Temporal Database Concepts, Spatial and Multimedia Databases, Data Mining, Active Database System, Deductive Databases, Database Machines, Web Databases, Advanced Transaction Models, Issues In Real Time Database Design.

## **UNIT-IV**

### **Introduction to Expert Database And Fuzzy Database System:**

**Expert Databases:** Use of Rules of Deduction in Databases, Recursive Rules.

**Fuzzy Databases:** Fuzzy Set & Fuzzy Logic, Use of Fuzzy Techniques to Define Inexact and Incomplete DataBases.

### **Suggested Readings:**

1. Majumda & Bhattacharya, "Database Management System", TMH.
2. Korth, Silbertz, Sudarshan, "Database Concepts", McGraw Hill.
3. Elmasri, Navathe, "Fundamentals of Database Systems", Addison Wesley.
4. Data C J, "An Introduction to Database System", Addison Wesley.
5. Ramakrishnan, Gehrke, "Database management System", McGraw Hill.
6. Bernstein, hadzilacous, Goodman, "Cocurrency Control & Recovery", Addison Wesley
7. Ceri & Palgatti, "Distributed Database", McGraw Hill.

## **2. Neural Network (2-1-0)**

### **UNIT-I**

Introduction: Neural Network, Human Brain, Biological and Artificial Neurons, Model of Neuron Knowledge Representation, Artificial Intelligence and Neural Network, Network Architecture, Basic Approach of the working of ANN- Training, Learning and Generalization.

### **UNIT-II**

Supervised Learning: Single Layer Networks, Perception- Linear Separability, Limitations of Multi Layer Network Architecture, Back Propagation Algorithm (BPA) and Other Training Algorithms, Application of Adaptive Multi- Layer Network Architecture, Recurrent Network, Feed-Forword Networks Radial-Basic-Function (RBF) Networks.

### **UNIT-III**

Unsupervised Learning: Winner- Task-All Networks, Hamming Networks, Maxnet, Simple Competitive Learning Vector- Quantization, Counter-Propoagation Network, Adaptive Resonance Theory, Kohonen's Self Organizing Maps, Principal Component Analysis.

### **UNIT-IV**

Associated Models: Hopfield Networks, Brain-In-A-Box Network, Boltzman

Machine Optimization Methods: Hopfield Networks For-TSP, Solution of Simultaneous Linear Equations, Iterated Gradient Descent, Simulated Annealing, Genetic Algorithm.

**Suggested Readings:**

1. Simon Haykin, "Neural Network – A Comprehensive Foundation", Macmillan Publishing Co., New York, 1994.
2. K. Mahotra, C.K. Mohan and Sanjay Ranka, "Elements of Artificial Neural Network", MIT Press, 1997- Indian Reprint Penram International Publishing (India), 1997
3. A Cichocki and R. Unbehauen, "Neural Networks for optimization and Signal processing", John Wiley and Sons, 1993.
4. J.M. Zurada, "Introduction to Artificial Neural network", (Indian edition) Jaico Publishers, Mumbai, 1997.
5. Limin Fu. "Neural Networks in Computer Intelligence", TMH.

**3. Natural Language Processing (2-1-0)**

**UNIT-I**

Introduction to Natural Language Understanding, Language as Knowledge Base Process, Basic Linguistics, Computers & Natural Language Understanding, Grammar & Parsing-Top Down Parsing, Bottom Up Parsing

**UNIT-II**

Transition Network Grammar, Grammar and Logic Programming, Semantic Interpretation-Semantic and Logical Form, Linking Syntax and Semantics, Ambiguity Resolution

**UNIT-III**

Introduction to Semantic Grammar, Template Matching, Semantically Driven Parsing Techniques Context and World Knowledge, Knowledge Representation and Reasoning

**UNIT-IV**

Local Discourse Context and Reference, Discourse Structure and Understanding Using World Knowledge, Language Learning and Concept Learning

**Suggested Readings:**

1. James Allen, Natural Language Understanding, Pearson Education.
2. Rich & Knight, Artificial Intelligence, TMH.
3. Dan W. Patterson, Artificial Intelligence: A Modern Approach, Pearson Education.
4. Russell Norwig, Artificial Intelligence: A Modern approach, Pearson Education.

**4. Digital Signal Processing (2-1-0)**

**UNIT-I**

Introduction of Signals System and Signal processing, Classification of Signal and System, Advantages of digital over Analog Signal processing, Signal models- Continuous Time Versus Discrete time signals, Periodic and Aperiodic Signals, Phasor Signals and Spectra, Energy and Power Signals, System Modeling Concepts, The superposition integral for fixed and linear Systems, Impulse Response of Fixed and Linear System- Fourier Series – Trigonometric Series- Exponential Fourier Series- Exponential Fourier Series- Symmetry Properties of the Fourier Coefficients.

**UNIT-II**

Fourier Integral, Energy Spectral Density, Fourier Transforms in the Limit, Fourier Transform Theorems and Paris, System Analysis with Fourier Transform, Laplace Transform Theorems, Network Analysis using the Laplace Transform.

Discrete Time signals and system- Review of sampled data System, Time Domain representation of Discrete Time Signals, Frequency Domain Representation of Discrete Time Signals, Discrete Time Signal obtained by sampling, Discrete Fourier

### **UNIT-III**

Transform. Z- Transform- Definition and Examples, Inverse Z- Transform, Properties of the Z- Transform, Introduction to Realization of Digital System- Block Diagram and Signal Flow Graph. Introduction to Realization of an IIR and FIR systems, Discrete Fourier Transforms (DTF) and Fast Fourier Transform (FFT)

### **UNIT-IV**

Design of Digital Filters: Introduction to Filters, A comparison of IIR and FIR Digital Filters. Design of IIR Digital Filters- Impulse Invariant Transformation, Bilinear Transformation, Design of Digital Butterworth and chebyshev Filters. Design of FIR Digital Filters- Windowing wing and Rectangular Window, Filter Designs using windows, Frequency Sampling Techniques in various applications.

### **Suggested Readings:**

1. Digital Signal Processing by Alan.V.Oppenheim, Ronal W. Schafer, Prentice Hall of India.
2. Digital Signal Processing by J. Defatta, John Willey & Sons.
3. Digital Signal Processing by Prokians, PHI.

## **5. Mobile Computing (2-1-0)**

### **Unit – I**

Introduction, issues in mobile computing, overview of wireless telephony: cellular concept, GSM: air-interface, channel structure, location management: HLRVLR, hierarchical, handoffs, channel allocation in cellular systems.

### **Unit II**

Wireless Networking, Wireless LAN Overview: MAC issues, IEEE 802.11, Blue Tooth, Wireless multiple access protocols, TCP over wireless, Wireless applications, data broadcasting, Mobile IP, WAP application environment, applications.

### **Unit – III**

Data management issues, data replication for mobile computers, adaptive clustering for mobile wireless networks, File system, Disconnected operations.

### **Unit IV**

Mobile Agents computing, security and fault tolerance, transaction processing in mobile computing environment, CDMA, GPRS.

### **References:**

1. J. Schiller, Mobile Communications, Addison Wesley.
2. Charles Perkins, Mobile IP, Addison Wesley.
3. Charles Perkins, Ad hoc Networks, Addison Wesley.
4. Upadhyaya, "Mobile Computing", Springer