## Annexure A

# DETAILED SYLLABUS
# MASTER OF COMPUTER APPLICATION (MCA)
# W.e.f. 2019-20

## Semester I

## MCA-101 Computer Architecture (3-1-0) Credit-04

**Objective:** To provide the hardware and architectural knowledge about the computer.

**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-04

**Objective:** To provide basic mathematical knowledge to be used for computation and algorithmic design.

**UNIT-I**

**Relation:** Type and Composition of relations, Pictorial Representation of Relations, Closures of Relations, Equivalence Relations, Partial Ordering RelationPosets, HasseDiagram,.

**Latties:** 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**

**Proportional Logic:** First Order Logic, Basic Logical Operations, Tautologies, Contradictions, Algebra of Preposition, 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, 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**

Push down Automata, Problems related to push down automata, Grammar, Types of Grammar, Chomsky Hierarchy, Bacus Naur Form, Reduction of context free grammar, Ambiguity in the grammar, Chomasky normal form, Greibacah normal form, Introduction of Turing Machine, Pumping lemmas for regular grammar and pumping lemma for context free grammar.

**Suggested Readings**


1.Liptschutz, 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 &Macmillam

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-04

**Objective:** To provide programming and object oriented concepts needed for further software developments.

**UNIT-I**

Object & Classes, Links and Associations Generalization and Inheritence, 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, Exmples and Case Studies to Demonstrate Methodology, Comparison of Methodology, SA/SD and JSD.

**Suggested Readings:**


1.Rambaugh James etal, **" 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, JonsceLajole, **" 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 (3-1-0) Credit-04

**Objective:** To provide basic mathematical and statistical knowledge to solve analytical problems computationally in efficient manner.

**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 Guassian 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, Guass 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, Linerar 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-04

**Based on MCA-103**

## MCAOE-101 Computer Fundamental and Organization (3-1-0) CREDIT: 04

**Objective**

- Describe the organization and operation of a computer processor, primary and secondary memory, peripheral devices;
- Explain the representation of data and information in computer systems

**Unit I**

Introduction of Computer, functions, different units of computer, Data, Information & Process. History & Generation of computer, Evolution of Computer, Input devices, Output devices, Types of VDU and Types of Printer, software and languages.

**Unit II**

Memory Of Computer , Internal Memory (RAM , ROM, Register, Cache Memory ) ,types of Ram and types of Rom, block diagram of Ram and Rom, Secondary Memory (Floppy Disk, Hard Disk ,Optical Disk ), cache memory, Virtual memory, Hierarchy of memory.

**Unit III**

Introduction of number system, number transformation ,number arithmetic in different bases –sum of two numbers ,difference of two number and product of two , BCD number, Ascii number, Logic Gates, Introduction of digital devices-decoder , encoder ,half adder, full adder, multiplexer.

**Unit IV**

Operating system, Evolution of operating System, Multiprogramming, Multiprocessing, Multitasking, sharing, Online processing, Booting Process, BIOS, Introduction of Linux and Unix, Internet and basic terms related to internet.

**Suggested Readings:**


1. V. Rajaraman: Computer Fundamental, PHI
2. Digital Logic and Computer Design: M.Morris Mano, PHI
3. Digital Principals and applications :Malvino and Leach,McGraw-Hill.

## Semester-II

### MCA-201 Graph Theory and Combinatorics (3-1-0) Credit-04

**Objective:** To provide the graph theoretic and counting knowledge to be used in computer science.

**UNIT-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, Eular 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, Dijkastra Algorithm, Path between All Vertex, Depth First Search, Breadth First Search.

**UNIT-IV**
Coloring of the Graph, Chromatic Number, Chromatic Polynomial, Planar Graph, Kurotowasky's Two Non Planar Graph, Kurotowaskies 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-04

**Objective:** To provide the knowledge about interface of hardware and software of computer.

**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.Biggerstaf, " System Software Tools", Prentice Hall
5.Ray Dunkan, "Advanced MS DOS Programming",BPB Publication
6.D.A. Norton, " System Programming & Operating System", Adison Wisley

## MCA-203 Data Structure (3-1-0) ` Credit-04

**Objective:** To provide knowledge storage of data and its application in computer programming.

**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",**Macmillian
3.Hiller, 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 Appraoch to Data structures and Algorithms**",New Age International Publishers
6. Schaum's Series, "**Introduction of Data Sructure**",Prentice Hall of India.

## MCA-204 Computer Based Optimization Techniques (3-1-0) Credit-04

**Objective:** To provide basic knowledge of optimization techniques to be used to optimize the real world problems.

**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. Hillller, 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-04

**Based on MCA 203**

**MCAOE-201 PROGRAMMING IN C (3-1-0) CREDIT: 04**

**Objective:**

- To provide basic concepts of programming using C language
- To make the students aware about the uses of data types, loops and structures in C

**Unit I**

Basics of programming: Approaches to Problem Solving, Concept of algorithm and flow charts, Fundamental data types- Character type, integer, short, long, unsigned, single and double floating point, Storage classes- automatic, register, static and external, Operators and expression using numeric and relational operators, mixed operands, type conversion, logical operators, bit operations, assignment operator, operator precedence and associatively.

**Unit II**

Conditional program execution: Applying if and switch statements, nesting if and else, use of break and default with switch, program loops and iterations: use of while, do while and for loops, multiple loop variables, use of break and continue statements.

**UNIT III**

Arrays: Array notation and representation, manipulating array elements, using multi dimensional arrays. Structure, union, enumerated data types. Pointers: Introduction, declaration, applications

**UNIT IV**

Functions: Introduction, types of functions, functions with array, passing values to functions, recursive functions, Introduction of File handling.

**Suggested Readings:**

1. The C programming by Kernighan Brain W. and Ritchie Dennis M., Pearson Education .

2. Computer Basics and C Programming by V.Rajaraman, PHI Learning Pvt. Limited – 2015.

3. Programming in C by Kochan Stephen G. Pearson Education – 2015.

4. Computer Concepts and Programming in C by D.S. Yadav and Rajeev Khanna, New Age International Publication.

## Semester-III

## MCA-301 Operating System (3-1-0) Credit-04

**Objective:** To provide technical knowledge about the interface between human and computer system.

**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

**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, Addision-Wesley.
2.Milan Milankovic, **"Operating System, Concepts jand Design",** Mc Graw-Hill
3.Harvey M Deital, "**Operating System",**addision-Wesley.
4.Richard Peterson, **"Linux: The Complete Referece",** 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 Applicantions**",TMH.

## MCA-302 Analysis & Design of Algorithm (3-1-0) Credit-04

**Objective:** To provide knowledge of designing and analysis of algorithms.

**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, Concatcnable 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 Geomety, Implementation in C++

**Suggested Readings:**

1.Horowitz Sahani, **"Fundamentals of Computer Algorithms",**Golgotia
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-04

**Objective:** To provide knowledge about the various steps to be used in software development.

**UNIT-I**

**Introduction:** Introduction to software engineering, Importance of software, The evolving role of software, Software Characteristic, Software Components, Software Application, Software Crisis. Spftwareemgineering 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 (3-1-0) Credit-04

**Objective:** To provide knowledge of java programming and its uses in internet programming.

**Unit-I**

Introduction, History Of Internet, Components Of Internet, Introduction To Internet Services, Internet Network, E-Mail Concepts: Architecture And Services, Messages Formats, Advantages, World Wide Web: Architectural Overview, Network Security.

**UNIT-II**

Introduction To Oops, Basics Of Java, Background Of Java, Java And The Internet, Advantages Of Java, Java Architecture/Components, Java Program Structure, Compiling And Running Java Program.

Operator, Data Type, Variable, Arrays, Input Output Statements, Control Statements And Lopping Structure, Methods & Classes, Constructors, Overloading, Nested Classes, String Handling.

**UNIT-III**

Inheritance Basics, Method Overriding, Abstract Classes, Creation And Importing Packages, Creating And Using Interface, Exception Handling, Multithread Programming, Java Thread Model, Thread Priorities, Implementing Runnable Interface, Extending Threads, Networking, Remote Method Invocation.

**UNIT-IV**

Internet Applets: Applet Basics, Applet Life Cycle, Images In Applet, Introduction To Abstract Window Toolkit (AWT), AWT Controls, Layout Managers, Event Handling, Graphics.

**Java Swing:** Creating A Swing Applet And Application, Programming Using Panes, Icons And Labels, Text Fields, Buttons: The JButton Class, Check Boxes, Radio Buttons, Check Box, Scroll Panes, Trees.

**Java Servlets :** Servlet Basics, Life Cycle Of A Servlet, Running Servlet, Debugging Servlets, Introduction To Java Server Pages(JSP). JDBC: The Connectivity Model, JDBC/ODBC Bridge, Java.Sql Package, Connectivity To Remote Database.

**Reference books:**


1. John Zukowski, Mastering Java
2. Deital & Deital, Java How To Program
3. Herbert Schildt, Java: The Complete Reference
4. E Balagurusamy, Programming With Java Tata Mcgraw Hill
5. Cay S. Horstmann, Gray Cornell, Core Java.


## MCA-305 Programming Lab III (0-0-4) Credit-04

**Based on MCA-302/MCA-304**

## Semester-IV

## MCA-401 Data Base Management System (3-1-0) Credit-04

**Objective:** To provide knowledge database storage and its management on computers.

**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 Indexs, Queries and Sub Queries, Aggregate Functions, Insert, update and delete operations, Joins, Unions, Intersection, Minus, Cursors in SQL, PI/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 transation failures, log based recovery, cheekpoints, 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, Multivesion 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 distrusted database.

**Suggested Readings:**


**1.**Date C.J., **"An Introduction to Database System"**, Addision Wesley
2.Korth, Silbertz, Sudarshan, **"Database Concepts",** Mc Graw Hill
3.Elmasri, Navathe, **"Fundamentals of Database System",**Addision 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-04

**Objective:** To provide knowledge of basic principles of compilation and designing to convert high level language to machine language.

**UNIT-I**

Introduction of Compilers and Translators, Phases of comiler, 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, Copilers: Principles, Techniques & Tools, Addision 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-04

**Objective:** To provide digital and logical knowledge about the computer network.

**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 Shannonhatnly Theorem, Transmitor, Channel Noise, Amplitude Modulation, Frequency Modulation, Sampling, Pulse Modulation, PWM, PDM, PPM, PCM.
Cmpression& Codes, Scheme Coherent and Non Coherent Detector, Probability of Error.(Pre).
Performances 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, 3rd 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-I (3-1-0) Credit-04

## MCA-405 Programming Lab IV (0-0-4) Credit-04

**Based on MCA-401**

# Semester-V

## MCA-501 Artificial Intelligence (3-1-0) Credit-04

**Objective:** To provide knowledge for developing intelligence in machines/computers.

**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, Addision 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-04

**Objective:** To provide the knowledge to give pictorial representation of real world and other mathematical entities.

**UNIT-I**

Graphics Display Devices, Interactive Devices, Line and Circle Plotting Using Breshenhams's Algorithm Windowing and Cliping, Suterland 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 to 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

## MCA-503 Distributed Computing (3-1-0) Credit-04

**Objective:** To provide the knowledge about the computing in distributed environment.

## Distributed Computing

**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.


## MCA-504 Elective Paper-II (3-1-0) Credit-04

## MCA-505 Elective Paper-III (3-1-0) Credit-04

## MCA-506 Programming Lab V (0-0-4) Credit-04

**Based on MCA-502**

# Semester VI

**MCA-601** Industrial Training and Project 24 Credits

**The weightage of internal and external assessment will be in the ratio 30% and 70 %.**

**Internal assessment will be based on**
i) SRS/Synopsis
ii) Design of project
iii) Project report

Each student will have to submit relevant document 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. External evaluation will be based on dissertation report and viva voce.

**Total credit score of all semester 144.**

## List of Electives:-

### 1) FOR SEMESTER IV

**Elective Paper-I**

A. Modeling & Simulation
B. Data Mining
C. Python Programming
D. ERP
E. Parallel Computing

### 2) FOR SEMESTER V

**Elective Paper-II**

A. Embedded Systems
B. Soft Computing
C. Digital Image Processing
D. Machine Learning

**Elective Paper-III**

A. Advance Database Management System
B. Neural Network
C. Natural Language Processing
D. Mobile Computing

## 1) List of Elective Papers-I (For MCA-404)

## A. Modeling & Simulation (3-1-0) **Credit 04**

**Objective:** To provide the knowledge about simulation and designing the relevant system models.

**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.
World Model: Critical Path Computation, Uncertainties in Activity Duration, Resource Allocation Simulation Software, Gerneral Purpose Vs Application-Oriented Simulation Packages

**Suggested Readings:**

1.Geoftrey 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

## B. Data Mining (3-1-0) Credit 04

**Objective:** To provide the knowledge about mining the facts from raw data using various techniques.

**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, DolfZantinge, **"Data-Mining"**, Pearson Education**.**

## C. Python Programming (3-1-0) Credit 04

**Objective:**

- To provide basic knowledge of programming in Python

**UNIT 1**

Two modes of using Python Interpreter , Variables and Data Types, Operators and their Precedence, Python Strings & Slicing, Python Lists, Mutable and Immutable Types, Input from the Keyboard.

Iteration: while and for loops, Python Syntax, Colon & Indentation, Syntax of 'for loops' , Conditional Execution: if, else if and else , Modify loops : break and continue.

**UNIT 2**

Functions, Optional and Named Arguments, Strings & Lists experiments, Split and Join Manipulating Lists , Copying Lists

Python Modules and Packages, Different ways to import Packages, File Input/Output The pickle module, Formatted Printing, Exception Handling.

**UNIT 3**

Turtle Graphics, Writing GUI Programs, Object Oriented Programming in Python, Inheritance, reusing code

The NumPy Module, Creating Arrays and Matrices, Copying, Arithmetic Operations, Cross product & Dot product , Saving and Restoring, Matrix inversion, Vectorized Functions

**UNIT 4**

File related modules in Python, File modes and permissions, Reading & Writing data from a file, Redirecting output streams to files, Working with directories, CSV files and Data Files

ODBC and Python, Working with Databases in MySQL, Working with Tables in MySQLManaging users in MySQL, Accessing MySQL data from Python, Working with SQLite Database

Launching HTTP server in Python, Creating own TCP server in Python, Making HTTP requests, Working with TCP & UDP

**Suggested Readings:**


1. Python for Education –Ajith Kumar B. P., Inter University Accelerator Center, New Delhi, 2010.
2. Python Training Guide –Mercury Learning & Information USA, BPB Publications, 2015

**D. ERP** **(3-1-0)** **Credit 04**

**Objective:**

- To understand in depth of business processes and the role of ERP

**Unit 1**

**Enterprise: An Overview*:*** Business Functions and Business Processes, importance of Information: Characteristics of information; Types of information, Information System: Components of an information system; Different types of information systems; Management information system, Enterprise Resource Planning: Business modelling; Integrated data model.

**Introduction to ERP**: Defining ERP, Origin and Need for an ERP System, Benefits of an ERP System, Reasons for the Growth of ERP Market, Reasons for the Failure of ERP Implementation: Roadmap for successful ERP implementation

**Unit 2**

ERP and Related Technologies: Business Process Re-engineering, Management Information systems, Decision Support Systems, Executive Information Systems- Advantages of EIS; Disadvantages of EIS, Data Warehousing, Data Mining, On-Line Analytical Processing, Product Life Cycle Management, Supply Chain Management, ERP Security, ERP Implementation Life Cycle.

**Unit 3**

**ERP Modules Structure:** Finance, Sales and Distribution, Manufacturing and Production Planning- Material and Capacity Planning; Shop Floor Control; Quality Management; JIT/Repetitive Manufacturing; Cost Management ; Engineering Data Management; Engineering Change Control ; Configuration Management ;Serialisation / Lot Control ;Tooling, Human Resource, Plant Maintenance- Preventive Maintenance Control; Equipment Tracking; Component Tracking;

**Unit 4**

*ERP: A Purchasing Perspective:* Role of ERP in Purchasing, Purchase Module: Features of purchase module; Benefits of purchase module, ERP Purchase System.

ERP: An CRM Perspective: Role of ERP in CRM, Concept of CRM: Objectives of CRM; Benefits of CRM; Components of CRM, Types of CRM: Operational CRM, Analytical CRM, Sales intelligence CRM, Collaborative CRM

**Suggested Readings:**


1. Enterprise Resource Planning: Concepts and Practice by Pankaj Garg
2. Enterprise Resource Planning by Alexis Leon
3. ERP Systems by Dimpi Srivastava and Aarti Batra
4. A Guide to ERP Benefits, Implementation and Trendsby Prof dr. Lineke Sneller RC

## E. Parallel Computing (3-1-0) Credit 04

**Objective:**

- To provide the knowledge about the concepts / techniques which can run parallelly on different machines.

**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, Massage 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, Guassian 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 effiecent Algorithms on parallel Computers, Mc- Graw Hill International, New York, 1987.
3. Parallel Algorithms, Dhallet,al., Mc-Graw Hill In

## 2) List of Elective Papers-II (For MCA-504)

### A. Embedded Systems (3-1-0) Credit 04

**Objective:**

- To provide the knowledge about the designing and testing of embedded systems.

**UNIT- I**

Introduction to Embedded systems, Architectural Isuues: 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.

## B. Soft Computing (3-1-0) Credit 04

**Objective:**

- To provide the knowledge about the heuristic techniques used for optimization.

**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 Artifical 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).

## C. Digital Image Processing (3-1-0) Credit 04

**Objective:**

- To provide the knowledge of digital image formation, reconstruction and manipulation etc.

**UNIT-I**

Why Digital Images; The Digital Camera; Data Types And 2d Representation of Digital Images; Discrete Sampling Model; Quantization; 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; Characterization 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 Constancy 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.

## D. Machine Learning (3-1-0) Credit 04

**Objective:**

- To understand machine learning problems corresponding to different applications and to assess how the choice of a machine-learning algorithm impacts the accuracy of a system.

**Unit I**

Introduction of Machine Learning, Basics of Linear Algebra and Statistics, Overview of target function representations; Supervised and unsupervised learning

**Unit II**

Regression-Least Mean Square and Recursive Least Square Algorithms; Clustering: K-Means, Hierarchical, and Density-based Clustering, Spectral Clustering. Decision Tree, Overfitting and Pruning, Logistic regression, Support Vector Machine and Kernel; Noise, bias-variance trade-off, under-fitting and over-fitting concepts.

**Unit III**

Single Layer Neural Network, Multilayer Perceptron, Back Propagation Learning, Functional Link Artificial Neural Network, and Radial Basis Function Network, Recurrent Neural Networks, Deep Learning, Convolutional Neural Networks.

**Unit IV**

Genetic Algorithm, Schemata Theorem, Differential Evolution, Particle Swarm Optimization, Ant Colony Optimization, Convergence Analysis.

**Suggested Reading:**

1. Tom Mitchell, "Machine Learning", Latest Edition, Mc-Graw Hill.
2. Shai Shalev-Shwartz, and Shai Ben-David, "Understanding Machine Learning", Cambridge University Press, 2017
3. Haykin S., Neural Networks and Learning Machines, Third Edition, Prentice Hall, 2008
4. NPTEL lectures on Introduction to Machine Learning.

## List of Elective Papers-III (For MCA-505)

## A. Advance Database Management System (3-1-0) Credit 04

**Objective:**

- To provide the knowledge of query processing and optimization techniques.

**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 ofDatabase 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.

## B. Neural Network (3-1-0) Credit 04

**Objective:**

- To provide the knowledge about training of neurons under various network layers.

**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 Rafiant Descent, Simulted Annealing, Fenetic Algorithm.

**Suggested Readings:**

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

## C. Natural Language Processing (3-1-0) Credit 04

**Objective:**

- To provide the knowledge about language and concept learning.

**UNIT-I**

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

**UNIT-II**
Transition Network Grammer, Grammer and Logic Programming, Semantic Interpretation-Semantic and Logical Form, Linking Syntax and Scemantics, Ambiguity Resolution

**UNIT-III**
Introduction to Semantic Grammer, 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.

## D. Mobile Computing (3-1-0) Credit 04

**Objective:** To provide the knowledge about the technologies and working of mobile devices.

**Unit – I**
Introduction, issues in mobile computing, overview of wireless telephony: cellular concept, GSM: air-interface, channel structure, location management: HLR-VLR, hierarchical, handoffs, channel allocation in cellular systems, CDMA, GPRS.

**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, application environment, applications.

**Unit – III**
Data management issues, data replication for mobile computers, adaptive clustering for mobile wireless networks, File system.

**Unit - IV**
Mobile Agents computing, security and fault tolerance, transaction processing in mobile computing environment, localization, MAC issues, Routing protocols, global state routing (GSR), QoS and its applications.

**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