# ADIKAVI NANNAYA UNIVERSITY

## Master of Computer Applications (MCA)

### Course Structure and Scheme of Valuation w.e.f. 2016-17

**III Semester**

| Code | Name of the subject | Periods/week | | Max Marks | | Total Marks | Credits |
|---|---|---|---|---|---|---|---|
| | | Theory | Lab | External | Internal | | |
| MCA 3.1 | Computer Networks | 4 | - | 75 | 25 | 100 | 4 |
| MCA 3.2 | Artificial Intelligence and Expert Systems | 4 | - | 75 | 25 | 100 | 4 |
| MCA 3.3 | Design and Analysis of Algorithms | 4 | - | 75 | 25 | 100 | 4 |
| MCA 3.4 | Operating Systems | 4 | - | 75 | 25 | 100 | 4 |
| MCA 3.5 | Web Technologies | 4 | - | 75 | 25 | 100 | 4 |
| MCA 3.6 | Operating Systems Lab | - | 3 | 50 | 50 | 100 | 2 |
| MCA 3.7 | Web Technologies Lab | - | 3 | 50 | 50 | 100 | 2 |
| | | | | | **Total** | **700** | **24** |

## MCA 3.1 COMPUTER NETWORKS

**Instruction:4 Periods/week** **Time: 3 Hours** **Credits:4**
**Internal:25 Marks** **External: 75 Marks** **Total: 100 Marks**

---

**UNIT I**

**Introduction to Computer Networks:** Introduction, Network Hardware, Network Software, Reference Models, Data Communication Services & Network Examples, Internet Based Applications.

**Data Communications:** Transmission Media, Wireless Transmission, Multiplexing, Switching, Transmission in ISDN, Broad Band ISDN, ATM Networks

**UNIT II**

Data Link Control, Error Detection & Correction, Sliding Window Protocols, LANs & MANs: IEEE Standards for LANs & MANs-IEEE Standards 802.2, 802.3, 802.4, 802.5, 802.6, High Speed LANs.

**Design Issues in Networks:** Routing Algorithms, Congestion Control Algorithms, Network Layer in the Internet, IP Protocol, IP Address, Subnets, and Internetworking.

**UNIT III**

**Internet Transport Protocols:** Transport Service, Elements of Transport Protocols, TCP and UDP Protocols, Quality of Service Model, Best Effort Model, Network Performance Issues.

Over View of DNS, SNMP, Electronic Mail, FTP, TFTP, BOOTP, HTTP Protocols, World Wide Web, Firewalls.

**UNIT IV**

**Network Devices:** Over View of Repeaters, Bridges, Routers, Gateways, Multiprotocol Routers, Brouters, Hubs, Switches, Modems, Channel Service Unit CSU, Data Service Units DSU, NIC, Wireless Access Points, Transceivers, Firewalls, Proxies.

Overview of Cellular Networks, Ad-hoc Networks, Mobile Ad-hoc Networks, Sensor Networks

**Text Books:**


1. Computer Networks, Andrews S Tanenbaum, Edition 5, PHI, ISBN: -81-203-1165-5
2. Data Communications and Networking, Behrouz A Forouzan, Tata McGraw-Hill Co Ltd, Second Edition


**Reference Books:**


1. Computer networks, Mayank Dave, Cengage.
2. Computer Networks, A System Approach, 5th ed, Larry L Peterson and Bruce S Davie, Elsevier.
3. An Engineering Approach to Computer Networks-S.Keshav, 2nd Edition,Pearson Education.
4. Understanding Communications and Networks, 3rd Edition, W.A. Shay, Thomson.

## MCA 3.2 ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS

| | | |
|---|---|---|
| **Instruction: 4 Periods/week** | **Time: 3 Hours** | **Credits: 4** |
| **Internal: 25 Marks** | **External: 75 Marks** | **Total: 100 Marks** |

---

**UNIT I**

What is AI, The Foundations of AI, The History of AI, Agents and Environments, The Concept of Rationality, The Nature of Environments, The Structure of Agents, Problem Solving Agents, Example Problems, Searching for Solutions, Uninformed Search Strategies: Breadth First, Depth First, Depth Limited; Informed Search Strategies: Greedy Best First, A* Algorithms

**UNIT II**

Heuristic Functions, Local-Search Algorithms and Optimization Problems: Hill Climbing, Simulated Annealing, Genetic Algorithms; Constraint Satisfaction Problems, Backtracking Search For CSPs, Games, Optimal Decisions in Games

Knowledge Based Agents, The Wumpus World, Logic, Propositional Logic, Reasoning Patterns in Propositional Logic, Syntax and Semantics of First Order Logic, Using First Order Logic, Inference in First-Order Logic: Unification, Resolution.

**UNIT III**

Acting Under Uncertainty, Basic Probability Notation, The Axioms of Probability, Inference Using Full Joint Distribution, Independence, Bayes Rule and Its Use, Other Approaches To Uncertain Reasoning: Dempster Shafer Theory, Fuzzy Sets and Fuzzy Logic

Combining Beliefs Under Uncertainty, The Basis of Utility Theory, Utility Functions, Multi Attribute Utility Functions, Decision Theoretic Expert Systems

**UNIT IV**

Expert System, Concepts and Characteristics, Applications and Domains of Expert System, Elements Of an Expert System, Stages in the Development of an Expert System, Semantic Nets, Frames

Speech Recognition, Forms of Learning, Inductive Learning, Learning Decision Trees, Single Layer Feed Forward, Multi Layer Feed Forward Neural Networks.

**Text Books:**


1. Artificial Intelligence: A Modern Approach. Stuart Russell, Peter Norvig, Pearson Education 2nd Edition.
2. Expert Systems : Principles and Programming. Joseph C Giarratano, Gary D Riley Thomson Publication, 4th Edition.


**Reference Books:**


1. Elaine Rich and Kevin Knight: Artificial Intelligence , Tata McGraw Hill.
2. Dan W.Patterson, Introduction to Artificial Intelligence and Expert Systems, Prentice Hall of India.
3. David W Rolston: Principles of Artificial Intelligence and Expert System Development, McGraw Hill

## MCA 3.3 DESIGN AND ANALYSIS OF ALGORITHMS

**Instruction: 3 Periods/week** **Time: 3 Hours** **Credits: 4**
**Internal: 25 Marks** **External: 75 Marks** **Total: 100 Marks**

---

**UNIT I**

**Introduction:** Fundamentals of algorithmic problem solving, important problem types, fundamental data structures.

**Fundamentals of analysis of algorithms and efficiency:** Analysis framework, Asymptotic Notations and Basic Efficiency classes, Mathematical Analysis of Non-recursive Algorithms, Mathematical Analysis of recursive Algorithms, Empirical Analysis of Algorithms, Algorithm Visualization.

**Brute Force:** Selection Sort and Bubble sort, Sequential Search and Exhaustive Search.

**UNIT II**

**Divide-and-Conquer:** Merge Sort, Quick sort, Binary Search, Binary Tree Traversals and Related Properties.

**Decrease-and-Conquer:** Insertion Sort, Depth-First Search and Breadth-First Search-Topological Sorting, Decrease-by-a-Constant-Factor Algorithms, Variable-Size-Decrease Algorithms.

**Transform-and-Conquer:** Presorting, Balanced Search Trees, Heaps and Heap sort, Problem Reduction.

**UNIT III**

**Space and Time Tradeoffs**: Sorting by Counting, Hashing, B-Trees.

**Dynamic Programming:** Warshall's and Floyd's Algorithm, Optimal Binary Search Trees, The Knapsack Problem and Memory Functions.

**Greedy Technique:** Prim's Algorithm, Kruskal's Algorithm, Dijkstra's Algorithm, Huffman Trees

**UNIT IV**

**Limitations of Algorithm Power:** Lower-Bound Arguments, Decision Trees, P, NP and NP-complete problems.

**Coping with the Limitations of Algorithms Power**: Backtracking, Branch-and-Bound, Approximation Algorithms for NP-hard Problems.

**Text Book:**

1. Introduction to Design & Analysis of Algorithms by Anany Levitin, Pearson Education, New Delhi, 2003

**Reference Books:**

1. Introduction to Algorithms by Thomas H. Corman, Charles E. Leiserson, Ron ald R. Rivest & Clifford Stein, Prentice Hall of India, New Delhi.
2. The Design and Analysis of computer Algorithms, Aho, Hopcroft & Ullman, Pearson Education, New Delhi, 2003
3. Fundamentals of algorithmics, Gilles Brassard & Paul Bratley, Prentice Hall of India, New Delhi

## MCA 3.4 OPERATING SYSTEMS

| | | |
|---|---|---|
| **Instruction: 4 Periods/week** | **Time: 3 Hours** | **Credits: 4** |
| **Internal: 25 Marks** | **External: 75 Marks** | **Total: 100 Marks** |

**UNIT I**

**Introduction:** Definition of Operating System, Types Of Operating Systems, Operating System Structures, Operating-System Services, System Calls, Virtual Machines, Operating System Design and Implementation,

**Process Management**: Process Concepts, Operations on Processes, Cooperating Processes, Threads, Inter Process Communication, Process Scheduling, Scheduling Algorithms, Multiple -Processor Scheduling. Thread Scheduling.

**UNIT II**

**Process Synchronization:** The Critical Section Problem, Semaphores, And Classical Problems of Synchronization, Critical Regions, Monitors, Synchronization examples.

**Deadlocks**: Principles of Deadlocks, System Model, Deadlocks Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Avoidance, Detection & Recovery from Deadlocks.

**UNIT III**

**Memory Management:** Logical Versus Physical Address, Swapping, Contiguous Memory Allocation, Paging, Structure of the Page Table, Segmentation, Virtual Memory, Demand Paging, Page Replacement Algorithms, Thrashing

**File System Implementation:** Concept of a file, Access Methods, Directory Structure, File System Structure, Allocation Methods, Free Space Management, Directory Management, Device Drivers.

**Mass-storage structure:** overview of Mass-storage structure, Disk structure, disk attachment, disk scheduling, swap-space management.

**UNIT IV**

**Protection:** Goals and Principles of Protection, Access matrix implementation, Access control, Revocation of access rights.

**Case study:** LINUX, Windows Operating Systems.

**Text Book:**

1. Operating System Principles by Abraham Silberschatz, Peter Galvin, Greg Gagne. Seventh Edition, Wiley Publication

**Reference Books:**

1. Operating Systems, William Stallings 5th Edition - PHI
2. Modern Operating Systems, Andrew S.Tanenbaum, , 2nd edition, 1995, PHI.
3. Operating Systems - A concept based approach, Dhamdhere, 2nd Edition, TMH, 2006.
4. Understanding the Linux Kernel, Daniel P Bovet and Marco Cesati, 3rd Edition,' Reilly, 2005.

## MCA 3.5 WEB TECHNOLOGIES

| | | |
|---|---|---|
| **Instruction: 4 Periods/week** | **Time: 3 Hours** | **Credits: 4** |
| **Internal: 25 Marks** | **External: 75 Marks** | **Total: 100 Marks** |

**UNIT I**

**Networking Protocols and OSI Model:** Protocols in Computer Communications, the OSI Model, OSI Layer Functions

**Internetworking Concepts, Devices, Basics, History and Architecture:** Internet working, Problems in Internetworking, Dealing with Incompatibility Issues, A Virtual Network, Internetworking Devices, Repeaters, Bridges, Routers, Gateways, A Brief History of the Internet, Growth of the Internet, Internet topology, Internal Architecture of an ISP

**TCP/IP Part I** (Introduction to TCP/IP, IP, ARP, RARP, ICMP):TCP/IP Basics, Why IP Addresses?, Logical Addresses,TCP/IP Example The Concept of IP Address, Address Resolution Protocol (ARP), Reverse ARP, Internet Control Message Protocol (ICMP), Datagram, Fragmentation and Reassembly

**UNIT II**

**TCP/IP Part II** (TCP, UDP):Basics of TCP, Features of TCP, Relationship between TCP and IP, Ports and Sockets, Connections-Passive Open and Active Open, TCP connections, What Makes TCP Reliable?TCP Packet Format, Persistent TCP Connections, User Datagram Protocol , UDP Packet, Difference between UDP and TCP

**TCP/IP Part III** (DNS, Email, FTP, TFTP): Domain Name System (DNS), Electronic Mail (Email), File Transfer Protocol (FTP)**,** Trivial File Transfer Protocol (TFTP)

**TCP/IP Part IV** (WWW, HTTP, TELNET): A Brief History of WWW, Basics of WWW and Browsing, Locating Information on the Internet, HTML , Web Browser Architecture, Web Pages and Multimedia, Remote Login (TELNET).

**An Introduction to Electronic Commerce:** Aspects of Electronic Commerce, Types of E Commerce, Approaches for Developing E Commerce Solutions, Electronic Procurement, Phases in a Procurement Process, E-Procurement Models, E-Procurement Solutions, Trading Models, Buyer Side Purchasing, Supply Chain Management (SCM) and Customer Relationship Management (CRM)

**UNIT III**

**Introduction to Web Technology:** Features Required for Enabling e-commerce, Web pages-Types and Issues, Tiers, The Concept of a Tier, A Concept of Microsoft and Java Technologies, Web Pages,Static Web Pages, Plug-ins, Introduction to Frames and Forms

**Dynamic Web Pages:** Need for Dynamic Web Pages,Magic of Dynamic Web Pages, Overview of Dynamic Web Page Technologies,Overview of Dynamic HTML (DHTML), Common Gateway Interface (CGI), Microsoft's Active Server Pages (ASP), Basics of ASP Technology, ASP Example, Modern Trends in ASP, Java and the Concept a Virtual Machine, Java Servlets and Java Sever pages(JSP), Java Servlets, Java Sever pages (JSP).

**Active Web pages:**Active Web pages is a Better Solution, Java Applets, Why are Active Web Pages Powerful? When not to use Active Web Pages, Lifecycle of Java Applets, Java Beans, Active X Controls.

**UNIT IV**

**Middleware and Component-based E-commerce Architectures:**CORBA, Java Remote Method Invocation (RMI), Microsoft's Distributed Component Object Model

**Electronic Data Interchange** (EDI): An Overview of EDI, the Origins of EDI, Understanding EDI, Data Exchange Standards, EDI Architecture, The Significance of EDI in International Trade, Financial EDI, EDI and the Internet.

**Extensible Markup Language** (XML):Standard Generalized Markup Language (SGML), Basics of XML, XML parsers, The Need for a Standard.

**Wireless Application Protocol** (WAP):Limitations of Mobile Devices, The emergence of WAP, WAP Architecture, The WAP Stack, Concerns about WAP and its Future, Alternatives to WAP.

**Text Book:**

Web Technologies : TCP/IP to Internet Application Architectures-TATA McGraw Hill Publications – Achyut S Godbole, Atul Kahate

## MCA 3.6 OPERATING SYSTEMS LAB

**Practical: 3 Periods /week** **Time: 3 Hours** **Credits: 2**
**Internal: 50 Marks** **External: 50 Marks** **Total: 100 Marks**

---

**List of Experiments:**

1. Basic UNIX commands

**Implement the following using Shell Programming**

2. Input number even or odd
3. Count the number of lines in the input text
4. Print the pattern
```
*
***
*****
```
5. File encryption

**Implement the following using C/C++/JAVA**

6. FCFS CPU scheduling algorithm
7. SJF CPU scheduling algorithm
8. Round Robin CPU scheduling algorithm
9. Priority CPU scheduling algorithm
10. Implement Semaphores
11. Sequential file allocation strategy
12. Indexed file allocation strategy
13. Bankers Algorithm for Dead Lock Avoidance
14. Algorithm for Dead Lock Detection
15. FIFO Page Replacement Algorithm
16. LRU Page Replacement Algorithm
17. LFU Page Replacement Algorithm

**References :**


1. Operating System Principles by Abraham Silberschatz, Peter Galvin, Greg Gagne. Seventh Edition, Wiley Publication
2. Understanding the Linux Kernel, Daniel P Bovet and Marco Cesati, 3rd Edition, Reilly, 2005.
3. Unix programming, Stevens, Pearson Education.
4. Shell programming, Yashwanth Kanetkar.

## MCA 3.7 WEB TECHNOLOGIES LAB

| | | |
|---|---|---|
| **Instruction: 3 Periods/week** | **Time: 3 Hours** | **Credits: 2** |
| **Internal: 50 Marks** | **External: 50 Marks** | **Total: 100 Marks** |

**List of Experiments:**

1. Create web pages for an application demonstrating the working of different features of HTML and DHTML.
2. Demonstrate the use of CSS in organizing the layout of webpages

**Implement at least two Java Script programs to demonstrate the working of**

3. Conditional statements
4. Looping statements.
5. Arrays
6. Functions.
7. Event handling
8. Validation controls.

**Develop simple applications for the following**

9. Exercise client server programming using Java Script, Servlets, ASP, JSP
10. Create a web application with database connectivity and work on different queries for data manipulation.

**References:**


1. Web Technologies, Godbole, Kahate, 2nd Ed., TMH
2. Internet & World Wide Web How to program, Dietel & Deitel Fourth Edition, PHI
3. Web Programming, building internet applications, 2nd Ed., Chris Bates, Wiley Dreamtech
4. The complete Reference HTML and DHTML, Thomas A. Powey
5. Core Servlets and Java Server Pages, Marty Hall Larry Brown, Second Edition

# ADIKAVI NANNAYA UNIVERSITY
## Master of Computer Applications(MCA)
### Course Structure and Scheme of Valuation w.e.f. 2016-17

**IV Semester**

| Code | Name of the subject | Periods/week | | Max Marks | | Total Marks | Credits |
|---|---|---|---|---|---|---|---|
| | | Theory | Lab | External | Internal | | |
| MCA 4.1 | Information Security and Cryptography | 4 | - | 75 | 25 | 100 | 4 |
| MCA 4.2 | Operations Research | 4 | - | 75 | 25 | 100 | 4 |
| MCA 4.3 | Elective I | 4 | - | 75 | 25 | 100 | 4 |
| MCA 4.4 | Object Oriented Software Engineering | 4 | - | 75 | 25 | 100 | 4 |
| MCA 4.5 | Data Warehousing and Data Mining | 4 | - | 75 | 25 | 100 | 4 |
| MCA 4.6 | Object Oriented Software Engineering Lab | - | 3 | 50 | 50 | 100 | 2 |
| MCA 4.7 | Data Mining Using R Programming Lab | - | 3 | 50 | 50 | 100 | 2 |
| | | | | | **Total** | **700** | **24** |

MCA 4.3 Elective I: 4.3.1 Advanced Data Structures

4.3.2 Computer Graphics

4.3.3 Distributed Systems

## MCA 4.1 INFORMATION SECURITY AND CRYPTOGRAPHY

| | | |
|---|---|---|
| **Instruction: 4 Periods/week** | **Time: 3 Hours** | **Credits: 4** |
| **Internal: 25 Marks** | **External: 75 Marks** | **Total: 100 Marks** |

**UNIT I**

**Introduction:** The need for security-security approaches-principles of security-Plain Text and Cipher Text-substitution and Transposition Techniques-Encryption and Decryption-Symmetric and Asymmetric Cryptography-Stenography-key range and key size-types of attacks.

**Number Theory:** Introduction to number theory- Modular Arithmetic, Euclidean algorithm, Euler theorem, Fermat Theorem, Totient Function, Multiplicative and Additive Inverse.

**UNIT II**

**Symmetric Key Cryptographic Algorithms:** Algorithm types and modes-overview of symmetric key cryptography-DES-IDEA-Blowfish-AES-Differential and Linear Cryptanalysis.

**Asymmetric Key Cryptographic Algorithms:** Overview of asymmetric key cryptography-RSA algorithm-symmetric and asymmetric key cryptography together-digital signatures.

**UNIT III**

**User Authentication Mechanisms**: Introduction-Authentication basics-passwords-authentication tokens-certificate based authentication-biometrics authentication-Hash functions-SHA1.

**System Security**: Intruders, Viruses, Related Threats, Trusted Systems.

**UNIT IV**

**Internet Security Protocols:** Basic concepts-SSL-SHTTP-TSP-SET-SSL versus SET- 3D secure protocol-Electronic money-Email security-WAP security-security in GSM.

**Network Security:** Brief Introduction to TCP/IP -Firewalls -IP security-Virtual Private Networks.

**Text Books:**

1. Cryptography and Network security, Atul Kahate, Tata McGraw-Hill Pub company Ltd., New Delhi
2. Network Security Essentials Applications and Standards, William Stallings, Pearson Education, New Delhi

**Reference Books:**

1. Network Security Private Communication in a public world, Charlie Kaufman, Radia Perlman & Mike Speciner, Prentice Hall of India Private Ltd., New Delhi
2. Network Security: The Complete Reference by Roberta Bragg, Mark Phodes - Ousley, Keith Strass berg Tata McGraw-Hill.

## MCA 4.2 OPERATIONS RESEARCH

| | | |
|---|---|---|
| **Instruction:4 Periods/week** | **Time: 3 Hours** | **Credits:4** |
| **Internal:25 Marks** | **External: 75 Marks** | **Total: 100 Marks** |

---

**UNIT I**

**Overview of Operations Research:** OR models – OR Techniques

**Linear Programming** : Introduction – Graphical solution; Graphical sensitivity analysis- The standard form of linear programming problems – Basic feasible solutions- unrestricted variables – simplex algorithm – artificial variables – Big M and two phase method – Degeneracy - alternative optima – unbounded solutions – infeasible solutions.

**UNIT II**

**Dual Problems :** Relation between primal and dual problems – Dual simplex method

**Transportation Model:** Starting solutions, North West corner Rule - lowest cost method, Vogels approximation method – Transportation algorithms – Assignment problem – Hungarian Method.

**UNIT-III**

**Network Models :** Definitions – CPM and PERT – Their Algorithms

**Integer Programming** : Branch and Bound Algorithms cutting plan algorithm.

**Dynamic Programming:** Recursive nature of dynamic programming – Forward and Backward Recursion

**UNIT-IV**

**Deterministic Inventory Models :** Static EOQ Models – Dynamic EOQ models.

**Game theory:** Two person Zero Sum Games – Mixed strategy games and their Algorithms.

**Text Books:**

1. Operations Research – An Introduction, Handy A Taha – Pearson Education .
2. Operations Research Panneer Selvan Prentice Hall of India.

**Reference Books:**

1. Operations Research, SD Sharma
2. Operations Research Kanti Swaroop, PK Gupta, Man Mohan – Sultan Chand & Sons Education

## ELECTIVE I: MCA 4.3.1 ADVANCED DATA STRUCTURES

| | | |
|---|---|---|
| **Instruction: 4 Periods/week** | **Time: 3 Hours** | **Credits: 4** |
| **Internal: 25 Marks** | **External: 75 Marks** | **Total: 100 Marks** |

**UNIT-I**

**Skip Lists and Hashing:** Dictionaries, Linear List Representation, Skip List Representation-The Ideal Case, Insertion and Deletions, Assigning, The Class SkipNode and SkipList, Complexity, Hash Table Representation-Ideal hashing, Hashing with Linear open addressing, hashing with chains, An application-Text Compression-LZW Compression, Implementation of LZW Compression, LZW Decompression, Implementation of LZW Decompression.

**Lists, Stacks, Queues:** Implementation of the Stack ADT (Abstract Data Type) and the Queue ADT.

**Trees:** The Search Tree ADT- Biary Search Trees, AVL Trees, Splay Trees, Red Black Trees, B-Trees.

**UNIT-II**

**Priority Queues:** Introduction, Linked Lists, Heaps-Definitions, Insertion into a Max Heap, Deletion from a Max Heap, Applications-Heap Sort, Machine Scheduling, Huffman Codes.

**Sorting algorithms:** General Background, Efficiency considerations, O Notation, Efficiency of Sorting, Exchange sorts: Bubble sort, quick sort, Insertion sorts: Simple insertion, Shell Sort, Address Calculation Sort, Merge and Radix sorts

**The Disjoint Set Class:** Equivalence Relations, the Dynamic Equivalence Problem, Basic Data Structure, Smart Union Algorithms, Path Compression, Worst Case for Union-by-Rank and Path Compression, an Application.

**UNIT-III**

**Graph Algorithms:** Definition, Topological Sort, Shortest-Path Algorithms, Network Flow Problems, Minimum Spanning Tree, Applications of Depth-First Search, Introduction to NP-Completeness.

**Algorithm Design Techniques:** Greedy Algorithms, Divide and Conquer, Dynamic Programming, Randomized Algorithms, Backtracking Algorithms.

**UNIT-IV**

**Amortized Analysis:** An Unrelated Puzzle, Binomial Queues, Skew Heaps, Fibonacci Heaps, Splay Trees.

**Advance Data Structures and Implementation:** Top-Down splay Trees, Red-Black Trees, Deterministic Skip Lists, AA-Trees, Treaps, k-d Trees, Pairing Heaps.

**Text Books**

1. Data Structures and Algorithm Analysis in C++, Mark Allen Weiss, Pearson Education , Second edition
2. Data structures, Algorithms and Applications in C++,S.Sahni, McGraw-Hill international Edition.
3. Data structures and Algorithms in C++, Michael T.Goodrich, R.Tamassia and D.Mount, Wiley student edition, John Wiley and Sons.

## ELECTIVE I: MCA 4.3.2 COMPUTER GRAPHICS

| | | |
|---|---|---|
| **Instruction: 4 Periods/week** | **Time: 3 Hours** | **Credits: 4** |
| **Internal: 25 Marks** | **External: 75 Marks** | **Total: 100 Marks** |

---

**UNIT I**

**Introduction:** Computer Graphics and their applications,Graphics- Computer Aided Design-ComputerArt-Entertainment-Education and Training- Visualization- Image Processing-Graphical User Interfaces; Overview of Graphics systems: Video Display Devices, Raster Scan systems, random scan systems, Graphics monitors and workstations, Input devices, hard copy devices, Graphics software.

**Output primitives :**Points and Lines, Line Drawing Algorithms, Loading the Frame buffer, Line function, Circle Generating Algorithms, Ellipse Generating Algorithms-, Other Curves, Parallel Curve Algorithms, Curve Functions, PixelAddressing, Filled Area Primitives, Filled Area Functions, Cell Array, Character Generation, Line and Curve Attributes-Color and Grayscale levels Character Attributes, -Area Fill Attributes, Bundled Attributes, Inquiry Functions , Antialiasing**.**

**UNIT II**

**Two Dimensional Geometric Transformations:** Basic Transformations, Matrix Representations, Homogeneous Coordinates, Composite Transformations, Other Transformations, Transformations between Coordinate Systems, Affine Transformations, Transformation Functions, Raster methods for Transformation.

**Two Dimensional Viewing:**The viewing Pipeline, Viewing Coordinate Reference Frame, Window-to-Viewport Coordinate Transformation, Two Dimensional Viewing Functions, Clipping Operations, Point Clipping, Line Clipping, Polygon Clipping-Curve Clipping, Text and Exterior Clipping

**UNIT III**

**Structure And Hierarchical Modeling:** Concepts of Structures and Basic models, Editing, Hierarchical Modeling with Structures, GUI and Interactive Input Methods- Windows and Icons, Virtual Reality Environments

**Three Dimensional Concepts and Object representations:** 3D displaymethods-3D Graphics, Polygon Surfaces, Curved Lines and Surfaces, Quadratic Surfaces, Super Quadrics, Blobby Objects, Spline Representations, Cubic Spline methods, Bezier Curves and Surfaces, BSpline Curves and Surfaces

**UNIT IV**

**Three Dimensional Geometric and Modeling Transformations:** Translation-, Rotation, scaling, Other Transformations, Composite Transformations, 3DTransformation Functions, Modeling and Coordinate Transformations

**Three Dimensional Viewing:** Viewing Pipeline-Viewing Coordinates, Projections, General Projection Transformations, Clipping,Hardware Implementations, 3D Viewing

**Text Book:**


1. Computer Graphics C Version, DonaldHearn & M.PaulineBaker, PearsonEducation,NewDelhi,2004 (Chapters1to12 except10-9to10-22)


**Reference Books:**


1. Procedural Elements for Computer Graphics, DavidF.Rogers, TataMcGraw HillBook Company,NewDelhi,2003
2. Computer Graphics: Principles & Practice in C, J.D.Foley, S.KFeiner, AVanDam F.H John Pearson Education, 2004

## ELECTIVE I: MCA 4.3.3 DISTRIBUTED SYSTEMS

**Instruction: 3 Periods/week** **Time: 3 Hours** **Credits: 4**
**Internal: 25 Marks** **External: 75 Marks** **Total: 100 Marks**

---

**UNIT I**

**Introduction to Distributed Systems:** Distributed systems: Goals, Hardware Concepts: Bus Multiprocessor Timesharing Systems, Design Issues: Reliability, Performance, Scalability etc.

**UNIT II**

**Communication distributed systems:** ATM Networks: Asynchronous Transfer Mode, The ATM Physical Layer, The ATM Layer, The ATM Adaptation Layer, ATM Switching, Applications of ATM for DS, Client-server model: Clients and Servers, Addressing, Blocking versus Nonblocking Primitives, Buffered versus Unbuffered Primitives, Reliable versus Unreliable Primitives, Implementing the Client-Server Model. Remote procedure call:RPC Operation, RPC semantics in the presence of Failures,Implementation issues.

**Synchronization:** Clock synchronization: Logical Clocks, Physical Clocks, Clock Synchronization Algorithms, Use of Synchronized Clocks, Mutual exclusion:Centralized Algorithm, Distributed Algorithm,Token Ring Algorithm,Comparison of the Three Algorithms, Election Algorithms: The Bully Algorithm, A Ring Algorithm, Atomic Transactions: Introduction, The Transaction Model, Implementation, concurrency Control, Dead locks.

**UNIT III**

**Processes and Processors:** Threads: Introduction, Thread Usage, Design Issues for Thread packages, Implementing a Thread Package, Threads and RPC, System models: The Workstation Model, The Processor pool model, A hybrid model, Processor allocation – Scheduling in Distributed Systems, Fault tolerance: Component Faults, System failures, Real time distributed systems: Design Issues, Real Time Communication, Real Time Scheduling.

**Distributed file systems:** Distributed File system design:File Service Interface, Directory Server interface, File System Implementation: File Usage, System Structure, Caching, Replication.

**UNIT IV**

**Distributed Shared Memory:**Introduction, Bus based multi processors, Ring based multiprocessors,Switched multiprocessors, Comparison of shared memory Systems, Consistency Models: Strict Consistency, Sequential Consistency, Causal Consistency, PRAM Consistency and Processor Consistency, Weak Consistency, Release Consistency, Entry Consistency, Page based distributed shared memory: Replication, Granularity, Achieving Sequential Consistency, Finding the owner, finding copies, page replacement, Synchronization.

**Text Book:**

1. Andrew S.Tanenbaum: Distributed Operating System, Prentice Hall Intl Inc 1995.

**Reference Book:**

1. Distributed Systems – Concepts and Design, George Coulouris, Jean Dollimore, Tim Kindberg, Pearson Education.

## MCA 4.4 OBJECT ORIENTED SOFTWARE ENGINEERING

| | | |
|---|---|---|
| **Instruction: 3 Periods/week** | **Time: 3 Hours** | **Credits: 4** |
| **Internal: 25 Marks** | **External: 75 Marks** | **Total: 100 Marks** |

---

**UNIT I**

**Introduction to Object Oriented Software Engineering:** Nature of the Software, Types of Software, Software Engineering Activities, Software Quality

**Introduction to Object Orientation:** Data Abstraction, Inheritance & Polymorphism, Reusability in Software Engineering, Examples: Postal Codes, Geometric Points.

**Requirements Engineering:** Domain Analysis, Problem Definition and Scope, Types of Requirements, Techniques for Gathering and Analyzing Requirements, Requirement Documents, Reviewing Requirements, Case Studies: GPS based Automobile Navigation System, Simple Chat Instant Messaging System.

**UNIT II**

**Unified Modeling Language & Use Case Modeling:** Introduction to UML, Modeling Concepts, Types of UML Diagrams with Examples; User-Centred Design, Characteristics of Users, Developing Use Case Models Of Systems, Use Case Diagram, Use Case Descriptions, The Basics of User Interface Design, Usability Principles.

**Class Design and Class Diagrams**: Essentials of UML Class Diagrams, Associations And Multiplicity, Generalization, Instance Diagrams, Advanced Features of Class Diagrams, Process of Developing Class Diagrams, Interaction And Behavioural Diagrams: Interaction Diagrams, State Diagrams, Activity Diagrams, Component and Deployment Diagrams.

**UNIT III**

**Software Design and Architecture:** Design Process, Principles Leading to Good Design, Techniques for Making Good Design Decisions, Good Design Document, Software Architecture, Architectural Patterns: The Multilayer, Client-Server, Broker, Transaction Processing, Pipe & Filter And MVC Architectural Patterns.

**Design Patterns:** Abstraction-Occurrence, General Hierarchical, Play-Role, Singleton, Observer, Delegation, Adaptor, Façade, Immutable, Read-Only Interface and Proxy Patterns.

**UNIT IV**

**Software Testing:** Effective and Efficient Testing, Defects in Ordinary Algorithms, Numerical Algorithms, Timing and Co-ordination, Stress and Unusual Situations, Testing Strategies for Large Systems.

**Software Project Management:** Introduction to Software Project Management, Activities of Software Project Management, Software Engineering Teams, Software Cost Estimation, Project Scheduling, Tracking And Monitoring.

**Software Process Models:** Waterfall Model, The Phased Released Model, The Spiral Model, Evolutionary Model, The Concurrent Engineering Model, Rational Unified Process.

**Text Book:**


1. Object Oriented Software Engineering: Practical Software Development using UML and Java. Timothy C Lethbridge & Robert, Langaneire, Mc Graw Hill


**Reference Books:**


1. The Unified Modeling Language User Guide. Grady Booch,James Rumbaugh and Ivar Jacobson. Addison-Wesley.
2. Software Engineering; A Practitioner's Approach. Roger S Pressman.
3. Object-Oriented Software Engineering: Using UML, Patterns and Java, Bernd Bruegge and Allen H. Dutoit, 2nd Edition, Pearson Education Asia.

## MCA 4.5 DATA WAREHOUSING AND DATA MINING

| | | |
|---|---|---|
| **Instruction: 3 Periods/week** | **Time: 3 Hours** | **Credits: 4** |
| **Internal: 25 Marks** | **External: 75 Marks** | **Total: 100 Marks** |

---

**UNIT I**

**Data Warehouse and OLAP Technology: An overview** DataWarehouse Basic Concepts, Data Warehouse Modeling: Data Cube and OLAP, Data Warehouse Implementation

**Data Preprocessing**: An Overview,Data Cleaning,Data Integartion, DataReduction, Data Transformation and Data Discretization, From Data Warehousing to Data Mining

**UNIT II**

**Introduction to Data Mining**: Motivation and importance, What is Data Mining, Data Mining on what kind of data, What kinds of patterns can be mined, Which technologies are used, Which kinds of applications are targeted, Major issues in Data Mining.

**Getting to know your Data**: Data Objects and Attribute Types, Basic Statistical Descriptions of Data, Data Visualization, Measuring data Similarity and Dissimilarity.

**UNIT III**

**Concept Description: Characterization and comparison** What is Concept Description, Data Generalization by Attribute-Oriented Induction(AOI), AOI for Data Characterization, Efficient Implementation of AOI, AOI for Class comparisons.

**Mining Frequent Patterns, Associations and Correlations**: Basic Concepts, Frequent Itemset Mining Methods: Apriori method, generating Association Rules, Improving the Efficiency of Apriori, Pattern-Growth Approach for mining Frequent Item sets, Mining Frequent Itemsets using vertical data format, Mining Closed and Max Patterns.

**UNIT IV**

**Classification Basic Concepts**: Basic Concepts, Decision Tree Induction: Decision Tree Induction, Attribute Selection Measures, Tree Pruning, Bayes Classification Methods, Classification by Back Propagation, Suport Vector Machines.

**Cluster Analysis:** Cluster Analysis, Partitioning Methods, Heirarichal methods, Density based methods-DBSCAN and OPTICS.

**Text Book**:

1. Data Mining Concepts and Techniques—JiaweiHan, Micheline Kamber and Jian Pei,Morgan Kaufman Publications 3rd edition.

**Reference Books**:

1. Introduction to Data Mining –Pang-Ning Tan, Michael Steinbach, Vipin Kumar
2. Introduction to Data Mining, Adriaan, Addison Wesley Publication
3. Data MiningTechniques,A.K.Pujari,University Press

## MCA 4.6 OBJECT ORIENTED SOFTWARE ENGINEERING LAB

| | | |
|---|---|---|
| **Practical: 3 Periods /week** | **Time: 3 Hours** | **Credits: 2** |
| **Internal: 50 Marks** | **External: 50 Marks** | **Total: 100 Marks** |

---

The Unified Modeling Language (UML) is a standard language for specifying, visualizing, constructing and documenting the artifacts of software systems. The primary goal of UML is to provide users a ready-to-use, expressive visual modeling language so that they can develop and exchange meaningful models.

This lab deals with object oriented analysis and design of a software problem using UML concepts and notations. The tool used is Rational Rose Enterprise Edition. Any other open source tool is also recommended.

**Document the Software Project Management and Software Engineering activities for any two of the following projects. Any other project of interest also can be chosen.**

1. Student Result Management System
2. Library Management System
3. Payroll System
4. Bank Loan System
5. Railway Reservation System
6. Automatic Teller Machine
7. Hostel Management System
8. Hospital Management System
9. Online Shopping System
10. Blood Bank Management System
11. GPS
12. Journal Publication System
13. Chatroom Application
14. Social Media Application

**Software Project Management and Software Engineering activities specified below can be customized according to the features of the project.**

- Problem Statement
- Feasibility Study
- Software Requirements Specification Document
- Estimation of Project Metrics
- Entity Relationship Diagram
- Use Case Diagrams
- Class Diagram
- Sequence Diagrams
- Activity Diagrams
- State Chart Diagrams
- Test coverage

**References:**


1. The Unified Modeling Language User Guide. Grady Booch,James Rumbaugh and Ivar Jacobson. Addison-Wesley.
2. Object Oriented Software Engineering: Practical Software Development using UML and Java. Timothy C Lethbridge & Robert, Langaneire, Mc Graw Hill

## MCA 4.7 DATA MINING USING R PROGRAMMING LAB

| | | |
|---|---|---|
| **Instruction: 3 Periods/week** | **Time: 3 Hours** | **Credits: 2** |
| **Internal: 50 Marks** | **External: 50 Marks** | **Total: 100 Marks** |

Students should be aware of usage of few packages and libraries of R. They should also be familiar with few functions used in R for visualization.

1. Implement all basic R commands
2. Interact data through .csv files(Import from and export to .csv files).
3. Get and Clean data using swirl excercises.(Use 'swirl' package, library and install that topic from swirl).
4. Visualize all Statistical measures(Mean,Mode, Median, Range, Inter Quartile Range etc., using Histograms, Boxplots and Scatter Plots).
5. Create a data frame with the following structure.

| EMP ID | EMP NAME | SALARY | START DATE |
|---|---|---|---|
| 1 | Satish | 5000 | 01-11-2013 |
| 2 | Vani | 7500 | 05-06-2011 |
| 3 | Ramesh | 10000 | 21-09-1999 |
| 4 | Praveen | 9500 | 13-09-2005 |
| 5 | Pallavi | 4500 | 23-10-2000 |

   a. Extract two column names using column name.
   b. Extract the first two rows and then all columns.
   c. Extract 3rd and 5th row with 2nd and 4th column.
6. Write R Program using 'apply' group of functions to create and apply normalization function on each of the numeric variables/columns of iris dataset to transform them into
   i. 0 to 1 range with min-max normalization.
   ii. a value around 0 with z-score normalization.
7. Create a data frame with 10 observations and 3 variables and add new rows and columns to it using 'rbind' and 'cbind' function.
8. Create a function to discretize a numeric variable into 3 quantiles and label them as low, medium, and high. Apply it on each attribute of iris dataset to create a new data frame. 'discrete_iris' with Categorical variables and the class label.
9. Create a simple scatter plot using toothgrowth dataset using 'dplyr' library. Use the same data to indicate distribution densities using boxwhiskers.
10. Write R program to implement linear and multiple regression on 'mtcars' dataset to estimate the value of 'mpg' variable, with best $R^2$ and plot the original values in 'green' and predicted values in 'red'.
11. Write R Programs to implement k-means clustering, k-medoids clustering and density based clustering on iris dataset.
12. Write a R Program to implement decision trees using 'readingSkills' dataset.
13. Implement decision trees using 'iris' dataset using package party and 'rpart'.

**References:**


1. www.tutorialspoint.com/r
2. www.r-tutor.com
3. R and Data Mining: Examples and Case Studies Yanchang Zhao.

# ADIKAVI NANNAYA UNIVERSITY

## Master of Computer Applications(MCA)

### Course Structure and Scheme of Valuation w.e.f. 2016-17

### V Semester

| Code | Name of the subject | Periods/week | | Max Marks | | Total Marks | Credits |
|---|---|---|---|---|---|---|---|
| | | Theory | Lab | External | Internal | | |
| MCA 5.1 | Wireless and Adhoc Networks | 4 | - | 75 | 25 | 100 | 4 |
| MCA 5.2 | Cyber Security | 4 | - | 75 | 25 | 100 | 4 |
| MCA 5.3 | Big Data Analytics | 4 | - | 75 | 25 | 100 | 4 |
| MCA 5.4 | Elective II | 4 | - | 75 | 25 | 100 | 4 |
| MCA 5.5 | Elective III | 4 | - | 75 | 25 | 100 | 4 |
| MCA 5.6 | Advanced Programming: Cyber Security and Data Analytics Lab | - | 3 | 50 | 50 | 100 | 2 |
| MCA 5.7 | .NET Lab | - | 3 | 50 | 50 | 100 | 2 |
| | | | | | **Total** | **700** | **24** |

MCA 5.4 Elective II : 5.4.1Cloud Computing

5.4.2 Soft Computing

5.4.3 Mobile Computing

MCA 5.5 Elective III: 5.5.1 Image Processing

5.5.2 Bio-Informatics

5.5.3 Software Testing and Quality Assurance

## MCA 5.1 WIRELESS AND ADHOC NETWORKS

| | | |
|---|---|---|
| **Instruction: 4 Periods/week** | **Time: 3 Hours** | **Credits: 4** |
| **Internal: 25 Marks** | **External: 75 Marks** | **Total: 100 Marks** |

**UNIT I**

**Introduction**: Introduction to Wireless Networks, Various Generations of Wireless Networks, Virtual Private Networks- Wireless Data Services, Common Channel Signaling, Various Networks for Connecting to the Internet, Blue tooth Technology, Wifi-WiMax- Radio Propagation mechanism, Path loss Modeling and Signal Coverage

**Wireless Local Area Networks**: Introduction-WLAN topologies-IEEE 802.11 Standards, MAC Protocols,Comparision of 802.11 a,b,g and n Standards, HIPER LAN , ZigBee 802.15.4**,** Wireless Local Loop.

**UNIT II**

**Wireless Adhoc Networks**: Basics of Wireless Networks, Infrastructured Versus Infrastructureless Networks – Properties of Wireless, Ad hoc Networks, Types of Ad hoc Networks, Challenges in Ad hoc Networks –Applications of Wireless Ad Hoc Networks

**Routing Protcols for Ad hoc Networks**: Introduction-Proactive Routing Protocols- Reactive Routing protocols-Hybrid Routing Protocols-QoS Metrics-Energy impact issues in Routing.

**UNIT III**

**Mobile Ad hoc Networks (MANETs):** Overview, Properties of A MANET, Spectrum of MANET Applications, Routing and Various Routing Algorithms.

**Other Wireless Technologies:** Introduction, IEEE 802.15.4 and Zigbee, General Architecture, Physical Layer, MAC layer, Zigbee, WiMAX and IEEE 802.16, Layers and Architecture, Physical Layer, OFDM Physical layer.

**UNIT IV**

**Security in Ad hoc Networks**: Introduction- Security Attacks, Intrusion Detection System, Intrusion Prevention system, Intrusion Response system, Wired Equivalent Privacy (WEP) -A Security Protocol for Wireless Local Area Networks (WLANs), Security in MANETs.

**Text Books:**


1. Principles of Wireless Networks , Kaveth Pahlavan, K. Prasanth Krishnamurthy, Pearson Publications, Asia, 2002
2. Mobile Cellular Communications, G.Sasibhusan Rao, Pearson Publications.


**Reference Book**:


1. Guide to Wireless Ad hoc Networks: Series: Computer Communications and Networks, Misra, Sudip; Woungang, Isaac; Misra, Subhas Chandra, 2009, Springer

## MCA 5.2 CYBER SECURITY

**Instruction:4 Periods/week** **Time: 3 Hours** **Credits:4**
**Internal:25 Marks** **External: 75 Marks** **Total: 100 Marks**

---

**UNIT I**

**Information Security and Threats:** Information Security, Information Assets, Threats to Information Assets. **Fundamentals of Information Security:** Elements of information security, Principles and concepts – data security, Types of controls.

**Data Leakage:** Introduction – Data Leakage, Organizational Data Classification, Location and Pathways, Content Awareness, Content Analysis Techniques, Data Protection, DLP Limitations, DRM-DLP Conundrum.

**UNIT II**

**Cyber Security Introduction:** Cyber Security, Cyber Security policy, Domains of Cyber Security Policy: Laws and Regulations, Enterprise Policy, Technology Operations, Technology Configuration, Strategy Versus Policy.

**Cyber Security Evolution:** Productivity, Internet, e-commerce, Counter Measures, Challenges.

**UNIT III**

**Cyber Security Objectives:** Cyber Security Metrics, Security Management Goals, Counting Vulnerabilities, Security Frameworks, Security Policy Objectives.

**Guidance for Decision Makers:** Tone at the Top, Policy as a Project, Cyber Security Management: Arriving at Goals, Cyber Security Documentation.

**Cyber Governance Issues:** Net Neutrality, Internet Names and Numbers, Copyright and Trademarks, Email and Messaging.

**UNIT IV**

**Cyber User Issues**: Malvertising, Impersonation, Appropriate Use, Cyber Crime, Geo location, Privacy.

**Cyber Conflict Issues:** Intellectual property Theft, Cyber Espionage, Cyber Sabotage, Cyber Welfare.

**Cyber Management Issues:** Fiduciary Responsibility, Risk Management, Professional Certification, Supply Chain, Security Principles, Research and Development.

**Cyber Infrastructure Issue:** Banking and finance, Health care, Industrial Control systems.

**Text Books:**


1. NASSCOM, Handbook of Security Analyst, SSC/Q0901, 2015.
2. Jennifer L. Bayuk, J. Healey, P. Rohmeyer, Marcus Sachs, Jeffrey Schmidt, Joseph Weiss Cyber Security Policy Guidebook, John Wiley & Sons 2012.


**Reference Books:**


1. Rick Howard, Cyber Security Essentials, Auerbach Publications 2011.
2. Richard A. Clarke, Robert Knake, Cyberwar: The Next Threat to National Security & What to Do About It, Ecco 2010.
3. Dan Shoemaker Cyber security The Essential Body of Knowledge, 1st ed. Cengage Learning 2011.
4. Augustine, Paul T., Cyber Crimes and Legal Issues", Crecent Publishing Corporation, 2007

## MCA 5.3 BIG DATA ANALYTICS

| | | |
|---|---|---|
| **Instruction: 4 Periods/week** | **Time: 3 Hours** | **Credits: 4** |
| **Internal: 25 Marks** | **External: 75 Marks** | **Total: 100 Marks** |

**UNIT I**

**Data structures in Java**: Java concepts required for developing Map Reduce Programs: Linked List, Stacks, Queues, Sets, Maps; Generics: Generic classes and Type parameters, Implementing Generic Types, Generic Methods, Wrapper Classes, Concept of Serialization.

**Introduction to Big Data:** Big Data-definition, Characteristics of Big Data (Volume, Variety,Velocity, Veracity, Validity), Importance of Big Data , Patterns for Big Data Development, Data in the Warehouse and Data in Hadoop[Zikopoulos]

**UNIT II**

**Introduction to Hadoop:** Hadoop- definition, Understanding distributed systems and Hadoop,Comparing SQL databases and Hadoop, Understanding MapReduce, Counting words with Hadoop—running your first program, History of Hadoop, Starting Hadoop - The building blocks of Hadoop, NameNode, DataNode, Secondary NameNode, JobTracker and Task Tracker

**HDFS:** Components of Hadoop -Working with files in HDFS, Anatomy of a MapReduceprogram, Reading and writing the Hadoop Distributed File system -The Design of HDFS, HDFS Concepts, The Command-Line Interface, Hadoop Filesystem, The Java Interface, Data Flow, Parallel Copying with distcp, Hadoop Archives.

**UNIT III**

**MapReduce Programming:** Writing basic Map Reduce programs - Getting the patent data set,constructing the basic template of a Map Reduce program, Counting things, Adapting for Hadoop's API changes, Streaming in Hadoop.

**MapReduce Advanced Programming:** Advanced MapReduce - Chaining Map Reduce jobs,joining data from different sources.

**UNIT IV**

**Graph Representation in MapReduce:** Modeling data and solving problems with graphs,Shortest Path Algorithm, Friends-of-Friends Algorithm, PageRank Algorithm, Bloom Filters.

**Text Books:**


1. Understanding Big Data Analytics for Enterprise Class Hadoop and Streaming Data by Dirk deRoos, Chris Eaton, George Lapis, Paul Zikopoulos, Tom Deutsch, 1st Edition, TMH,2012.
2. Hadoop in Action by Chuck Lam, MANNING Publishers.
3. Hadoop in Practice by Alex Holmes, MANNING Publishers


**Reference Books:**


1. Hadoop: The Definitive Guide by Tom White, 3rd Edition, O'reilly
2. Big Java Fourth Edition Cay Horstmann Wiley, John Wiley & Sons
3. Mining of massive datasets, AnandRajaraman, Jeffrey D Ullman, Wiley Publications.

## ELECTIVE II: MCA 5.4.1 CLOUD COMPUTING

**Instruction: 4 Periods/week** **Time: 3 Hours** **Credits: 4**
**Internal: 25 Marks** **External: 75 Marks** **Total: 100 Marks**

---

**UNIT I**

**Cloud Computing Basics** - Cloud Computing Overview, Applications, Intranets and the Cloud, First Movers in the Cloud. The Business Case for Going to the Cloud - Cloud Computing Services, Business Applications, Deleting Your Datacenter, Salesforce.com, Thomson Reuters.

**Organization and Cloud Computing** - When You Can Use Cloud Computing, Benefits, Limitations, Security Concerns, Regulatory Issues, Cloud Computing with the Titans - Google, EMC, NetApp, Microsoft, Amazon, Salesforce.com, IBMPartnerships.

**UNIT II**

**Hardware and Infrastructure** - Clients, Security, Network, Services. Accessing the Cloud - Platforms, Web Applications, Web APIs,Web Browsers. Cloud Storage - Overview, Cloud Storage Providers, Standards - Application, Client, Infrastructure, Service.

**Software as a Service** - Overview, Driving Forces, Company Offerings, Industries Software plus Services - Overview, Mobile Device Integration, Providers, Microsoft Online.

**UNIT III**

**Developing Applications** - Google, Microsoft, Intuit QuickBase, Cast Iron Cloud, Bungee Connect, Development, Troubleshooting, Application Management.

**Local Clouds and Thin Clients** - Virtualization in Your Organization, Server Solutions, Thin Clients, Case Study: McNeilus Steel.

**UNIT IV**

**Migrating to the Cloud** - Cloud Services for Individuals, Cloud Services Aimed at the Mid-Market, Enterprise-Class Cloud Offerings, Migration, Best Practices and the Future of Cloud Computing - Analyze Your Service, Best Practices, How Cloud Computing Might Evolve.

**Text Books:**

1. Cloud Computing-A Practical Approach, Anthony T. Velte, Toby J. Velte, Robert Elsenpeter. McGrawHill.

**Reference Books:**

1. Cloud Computing, Theory and Practice, Dan C Marinescu, MK Elsevier.
2. Cloud Computing, A Hands on approach, Arshadeep Bahga, Vijay Madisetti, University Press

## ELECTIVE II: MCA 5.4.2 SOFT COMPUTING

| | | |
|---|---|---|
| **Instruction: 4 Periods/week** | **Time: 3 Hours** | **Credits: 4** |
| **Internal: 25 Marks** | **External: 75 Marks** | **Total: 100 Marks** |

---

**UNIT I**

**Soft Computing**: Introduction to Fuzzy Computing, Neural Computing, Genetic Algorithms, Associative Memory, Adaptive Resonance Theory, Different Tools and Techniques, Usefulness and Applications.

**Fuzzy Sets and Fuzzy Logic**: Introduction, Fuzzy Sets Versus Crisp Sets, Operations on Fuzzy Sets, Extension Principle, Fuzzy Relations and Relation Equations, Fuzzy Numbers, Linguistic Variables, Fuzzy Logic, Linguistic Hedges, Applications.

**UNIT II**

**Interference in fuzzy logic:** fuzzy if-then rules, Fuzzy implications and Fuzzy algorithms, Fuzzifications and Defuzzificataions, Fuzzy Controller, Fuzzy Controllers, Fuzzy Pattern Recognition, Fuzzy Image Processing, Fuzzy Database.

**Artificial Neural Network**: Introduction, Artificial Neuron and its model, activation functions, Neural network architecture: single layer and multilayer feed forward networks, re-current networks. Various learning techniques, perception and convergence rule, Auto-associative and hetro-associative memory , Hebb's Learning, Adaline, Perceptron.

**UNIT III**

**Multilayer Feed Forward Network**: Back Propagation Algorithms, Different Issues Regarding Convergence of Multilayer Perceptron, Competitive Learning, Self-Organizing, Feature Maps, Adaptive Resonance Theory, Associative Memories, Applications.

**Evolutionary and Stochastic Techniques**: Genetic Algorithm (GA), Genetic Representations, (Encoding) Initialization and Selection, Different Operators of GA, Analysis of Selection Operations, Hypothesis of Building Blocks, Schema Theorem and Convergence of Genetic Algorithm, Simulated Annealing and Stochastic Models, Boltzmann Machine, Applications.

**UNIT IV**

**Rough Set**: Introduction, Imprecise Categories Approximations and Rough Sets, Reduction of Knowledge, Decision Tables and Applications.

**Hybrid Systems**: Neural-Network-Based Fuzzy Systems, Fuzzy Logic-Based Neural Networks, Genetic Algorithm for Neural Network Design and Learning, Fuzzy Logic and Genetic Algorithm for Optimization, Applications

**Text Books:**


1. Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis and Applic ations, S. Rajsekaran and G.A. Vijayalakshmi Pai, Prentice Hall of India.
2. Rough Sets, Z.Pawlak, Kluwer Academic Publisher, 1991.
3. Intelligent Hybrid Systems, D. Ruan, Kluwer Academic Publisher, 1997


**Reference Books:**


1. Artificial Intelligence and Intelligent Systems, N.P.Padhy, Oxford University Press.
2. Neural Fuzzy Systems, Chin-Teng Lin & C. S. George Lee, Prentice Hall PTR.
3. Learning and Soft Computing, V. Kecman, MIT Press, 2001
4. Fuzzy Sets and Fuzzy Logic, Klir & Yuan, PHI, 1997

## ELECTIVE II: MCA 5.4.3 MOBILE COMPUTING

**Instruction: 4 Periods/week** **Time: 3 Hours** **Credits: 4**
**Internal: 25 Marks** **External: 75 Marks** **Total: 100 Marks**

---

**UNIT-I**

**Introduction to Mobile Communications and Computing:** Introduction to cellular concept, Frequency Reuse, Handoff, GSM: Mobile services, System architecture, Radio interface, Protocols, Localization and calling, Handover, Security, and New data services, Introduction to mobile computing, novel applications, limitations, and architecture.

**UNIT II**

**Wireless LANs:** Introduction, Advantages and Disadvantages of WLANs, WLAN Topologies, Introduction to Wireless Local Area Network standard IEEE 802.11, Comparison of IEEE 802.11a, b, g and n standards, Wireless PANs, Hiper LAN, Wireless Local Loop

**Wireless Networking:** Introduction, Various generations of wireless networks, Fixed network transmission hierarchy, Differences in wireless and fixed telephone networks, Traffic routing in wireless networks, WAN link connection technologies, X.25 protocol, Frame Relay, ATM, Virtual private networks, Wireless data services, Common channel signaling, Various networks for connecting to the internet.

**UNIT III**

**Database Issues:** Data management issues, data replication for mobile computers, adaptive clustering for mobile wireless networks, file system, disconnected operations.

**Data Dissemination:** Communications asymmetry, classification of new data delivery mechanisms, push-based mechanisms, pull-based mechanisms, hybrid mechanisms, selective tuning (indexing) techniques.

**UNIT IV**

**Mobile IP and Wireless Application Protocol:** Introduction to Mobile IP, Introduction to Wireless Application Protocol, Application layer.

**Text Books:**


1. Gottapu Sasibhushana Rao, "Mobile Cellular Communication", Pearson Education, First Edition, 2013.
2. Stojmenovic and Cacute, "Handbook of Wireless Networks and Mobile Computing", Wiley, 2002.

## ELECTIVE III: MCA 5.5.1 IMAGE PROCESSING

**Instruction: 4 Periods/week** **Time: 3 Hours** **Credits: 4**
**Internal: 25 Marks** **External: 75 Marks** **Total: 100 Marks**

---

**UNIT I**

**Fundamentals of Im age Processing:** Image Acquisition, Image Model, Sampling, Quantization, Relationship Between Pixels, Distance Measures, Connectivity, Image Geometry, Photographic Film.

**Histogram:** Definition, Decision Of Contrast Basing On Histogram, Operations Basing on Histograms Like Image Stretching, Image Sliding, Image Classification. Definition and Algorithm of Histogram Equalization.

**UNIT II**

**Image Transforms:** A Detail Discussion On Fourier Transform, DFT,FFT,

**Image Enhancement:**

a) Arithmetic and Logical Operations, Pixel or Point Operations, Size Operations,
b) Smoothing Filters-Mean, Median, Mode Filters – Comparative Study
c) Edge Enhancement Filters – Directorial Filters, Sobel, Laplacian, Robert, KIRSCH Homogeneity
d) Low Pass Filters, High Pass Filters, Sharpening Filters. – Comparative Study

**UNIT III**

**Image Enhancement:** Design of Low Pass, High Pass, EDGE Enhancement, Smoothening Filters in Frequency Domain. Butter Worth Filter, Homomorphic Filters in Frequency Domain Advantages of Filters in Frequency Domain, Comparative Study of Filters in Frequency, Domain and Spatial Domain.

**Image Compression:** Run Length Encoding, Contour Coding, Huffman Code, Compression Due to Change in Domain, Compression Due to Quantization Compression at the Time of Image Transmission. Brief Discussion on:- Image Compression Standards.

**UNIT IV**

**Image Segmentation:** Characteristics of Segmentation, Detection of Discontinuities, Thresholding Pixel Based Segmentation Method. Region Based Segmentation Methods, Segmentation by Pixel Aggregation, Segmentation by Sub Region Aggregation, Histogram Based Segmentation, Spilt and Merge Technique, Motion in Segmentation.

**Morphology:** Dilation, Erosion, Opening, Closing, Hit-And-Miss Transform, Boundary Extraction, Region Filling, Connected Components, Thinning, Thickening, Skeletons, Pruning Extensions to Gray – Scale Images, Application of Morphology in IP

**Text Book:**

1. Digital Image Processing, Rafael C. Gonzalez And Richard E. Woods, Addison Wesley

**Reference Books:**

1. Fundamentals Of Electronic Image Processing By Arthyr – R – Weeks, Jr.(PHI)
2. Image Processing, Analysis, And Machine Vision By Milan Sonka Vaclan Halava Roger Boyle, Vikas Publishing House.
3. Digital Image Processing, S. Jayaraman, S. Esakkirajan& T. Veera Kumar, TMH
4. Fundamentals of Digital Image Processing, Chris Solomon, Tobi Breckon, Wiley-Blackwell

## ELECTIVE III: MCA 5.5.2 BIO INFORMATICS

**Instruction: 4 Periods/week** **Time: 3 Hours** **Credits: 4**
**Internal: 25 Marks** **External: 75 Marks** **Total: 100 Marks**

---

**UNIT I**

**Introduction:** Definitions, Sequencing, Biological Sequence/Structure, Genome Projects, Pattern Recognition a Prediction, Folding Problem, Sequence Analysis, Homology and Analogy.

**Protein Information Resources**: Biological Databases, Primary Sequence Databases, Protein Sequence Databases, Secondary Databases, Protein Pattern Databases, and Structure Classification Databases.

**UNIT II**

**Genome Information Resources:** DNA Sequence Databases, Specialized Genomic Resources.

**DNA Sequence Analysis**: Importance Of DNA Analysis, Gene Structure And DNA Sequences, Features of DNA Sequence Analysis, EST (Expressed Sequence Tag) Searches, Gene Hunting, Profile of a Cell, EST Analysis, Effects Of EST Data on DNA Databases.

**UNIT III**

**Pair Wise Alignment Techniques** :Database Searching, Alphabets and Complexity, Algorithm and Programs, Comparing Two Sequences, Sub-Sequences, Identity and Similarity, The Dotplot, Local and Global Similarity, Different Alignment Techniques, Dynamic Programming, Pair Wise Database Searching.

**Multiple Sequence Alignment**: Definition and Goal, The Consensus, Computational Complexity, Manual Methods, Simultaneous Methods, Progressive Methods, Databases of Multiple Alignments And Searching.

**UNIT IV**

**Secondary Database Searching**: Importance and Need of Secondary Database Searches, Secondary Database Structure and Building a Sequence Search Protocol.

**Analysis Packages**: Analysis Package Structure, Commercial Databases, Commercial Software, Comprehensive Packages, Packages Specializing in DNA Analysis, Intranet Packages, Internet Packages.

**Text Books:**


1. Introduction To Bioinformatics, By T K Attwood & D J Parry-Smith Addison Wesley Longman
2. Bioinformatics- A Beginner's Guide By Jean-Michel Claveriw, Cerdric Notredame, WILEY Dreamlech India Pvt. Ltd


**Reference Books:**


1. Introduction To Bioinformatics By M.Lesk Oxford Publishers (Indian Edition)

## ELECTIVE III: MCA 5.5.3 SOFTWARE TESTING AND QUALITY ASSURANCE

| | | |
|---|---|---|
| **Instruction: 4 Periods/week** | **Time: 3 Hours** | **Credits: 4** |
| **Internal: 25 Marks** | **External: 75 Marks** | **Total: 100 Marks** |

---

**UNIT I**

**Basic concepts of quality and testing:** Quality revolution, Software Quality, Role of testing, Verification and validation, Failure, Error, Fault, and Defect, Objectives of testing, What is a Test Case, Expected Outcome, Testing activities, Test Levels, Sources of information for Test Case selection.

**Unit testing:** Unit testing basics, Static Unit testing, Defect prevention, Dynamic unit testing, Mutation Testing, Debugging, Unit testing in extreme programming, Tools for unit testing.

**Control flow testing:** Outline of Control flow testing, Control flow graph and Paths, Path Selection Criteria: All-path coverage criterion, Statement coverage criterion, Branch coverage criterion, Predicate coverage criterion, Generating test input, test data selection.

**UNIT II**

**Data flow testing:** General idea, Data flow anomaly, Data flow graph, Data flow terms, Data flow testing criteria.

**Domain testing:** Domain error, Testing for domain errors, Sources of domains, Types of domain errors, ON and OFF points, Test selection criterion.

**Integration testing:** Concept of integration testing, Different types of interfaces and interface errors, System integration techniques: Incremental, Top down, Bottom up, Sandwich and Big Bang, Test plan for system integration, Off-the-shelf component integration.

**UNIT III**

**Software Quality Assurance (SQA) :** The uniqueness of SQA, The environments for which SQA methods are developed, what is software, Software errors, faults and failures, classification of the causes of software errors, software quality-definition, SQA - definition and objectives.

**Software quality factors:** Classification of software requirements into software quality factors: Product operation, product revision, Product transition.

**Software quality assurance system:** The SQA system-an SQA architecture: Pre-project components, Software project life cycle components, Infrastructure components, Management SQA components.

**UNIT IV**

**CASE tools for software quality:** What is a CASE tool? The contribution of CASE tools software product quality, The contribution of CASE tools to improved project management.

**Software quality metrics:** Objectives of measurement, Classification of quality metrics, Process metrics, Product metrics, Implementation of quality metrics, Limitations of metrics.

**Quality management standards:**

The scope of quality management standards, ISO 9001 and ISO 9000-3, Capability maturity models-CMM and CMMI assessment methodology, The Bootstrap methodology, The SPICE project and the ISO/IEC 15504 software process assessments standard.

**Text books:**


1. Software Testing and Quality Assurance. Kshirasagar Nail, Priyadarshi Tripathy. John Wiley Publication.
2. Software Quality Assurance: From theory to implementation. Daniel Galin. Pearson Adison Wesley Publication.

## MCA 5.6 ADVANCED PROGRAMMING: CYBER SECURITY AND DATA ANALYTICS LAB

| | | |
|---|---|---|
| **Practical: 3 Periods /week** | **Time: 3 Hours** | **Credits: 2** |
| **Internal: 50 Marks** | **External: 50 Marks** | **Total: 100 Marks** |

---

**List of Experiments: Cyber Security**

1. Implement encryption and decryption substitution technique using Modified Caesar-Cipher
2. Implement One Time Pad Cipher algorithm
3. Implement Rail Fence transposition technique.
4. Implement RSA algorithm.
5. Calculate the message digest of a text using the MD5/SHA-1 algorithm
6. Generate digital signature using RSA & MD5/SHA-1
7. Experiment using NMAP/ZENMAP
8. Sniff network traffic using tool: Cain and Abel / Wireshark / tcpdump
9. Generate minimum 10 passwords of length 12 characters using openssl command
10. Study and use Snort IDS.

**Note:** A minimum of 5 experiments should be completed related to Cyber Security/Cryptography.

**References:**


1. Cryptography and Network security, Atul Kahate, Tata McGraw-Hill Pub company Ltd., New Delhi
2. NASSCOM, Handbook of Security Analyst, SSC/Q0901, 2015


**List of Experiments: Big Data Analytics**

1. Write a Java Program to implement Linked Lists, Stacks and Queues.
2. Write Java Program that implements Generic Types which collects pair of elements of different types.
3. Write a Java Program that uses object serialization and deserialization.
4. Know about setting up and Installing Hadoop in its three operating modes and implement in Standalone.
5. Implement the following file management tasks in Hadoop: Adding, Retrieving and deleting files.
   Hint: A typical Hadoop workflow creates data files (such as log files) elsewhere and copies them into HDFS using one of the above command line utilities.
6. Write a Map-Reduce Program to find average of numbers.
7. Implement Matrix Multiplication with Hadoop Map Reduce
8. Run a basic Word Count Map Reduce program to understand Map Reduce Paradigm.

**References:**


1. Big Java Fourth Edition Cay Horstmann Wiley, John Wiley & Sons
2. www.hadoop.apache.org
3. www.gist.github.com

## MCA 5.7 .NET LAB

| | | |
|---|---|---|
| **Instruction: 3 Periods/week** | **Time: 3 Hours** | **Credits: 2** |
| **Internal: 50 Marks** | **External: 50 Marks** | **Total: 100 Marks** |

**List of Experiments Using VB.NET and C#.NET**

1. Find whether a number is even or odd
2. Find the sum of the digits of a number
3. Accept a string and convert it to lower case
4. Develop a calculator application
5. Develop timer based quiz
6. Validation of login form
7. Exercise different controls like calendar control, data grid
8. Results processing with Database connectivity

**List of Experiments Using ASP.NET**

9. Develop simple web applications Using ASP.NET to understand the working of button control, label box, text box, check box, list box, image and other basic controls.
10. Write an ASP.NET application to simulate traffic lights.
11. Develop an ASP.NET application for online store with list of items. When the item is selected, display the image and when the image is selected, price should be displayed.
12. Develop ASP.NET application for validation of a login form
13. Create a simple project of your own using Database connectivity with ASP.NET.

**References:**


1. Visual Basic .Net for Experienced Programmers Harvey M Deitel
2. Visual Basic .NET The Complete Reference. Jeffrey R Shapiro Tata Mc-Graw Hill
3. Programming in C# by E.Balagurusamy.
4. The Complete Reference ASP.NET by Matthew Macdonald.

# ADIKAVI NANNAYA UNIVERSITY

## Master of Computer Applications (MCA)

### Course Structure and Scheme of Valuation w.e.f. 2016-17

### VI Semester

| Code | Name of the subject | Periods/week | | Max Marks | | Total Marks | Credits |
|---|---|---|---|---|---|---|---|
| | | Theory | Lab | External | Internal | | |
| MCA 6.1 | Project Work | - | - | 100 | 100 | 200 | 12 |