

**MASTER OF COMPUTER APPLICATION**

**MCA**

**Detailed syllabi for students admitted to KIIT University**



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**SCHOOL OF COMPUTER APPLICATION  
KIIT UNIVERSITY  
BHUBANESWAR - 751024**

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**COURSE STRUCTURES AND DETAILED SYLLABI FOR  
MCA PROGRAMME (2011– 2014)  
KIIT UNIVERSITY**  
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## COURSE STRUCTURES

### FIRST SEMESTER (AUTUMN)

<b>THEORY</b>						
<b>SL NO</b>	<b>COURSE CODE</b>	<b>SUBJECT</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>CREDIT</b>
01	MCA101	Programming Methodology	3	1	-	4
02	MCA102	Computer Architecture	3	1	-	4
03	MCA103	Accounting and Financial Management	3	1	-	4
04	MCA104	Information Systems	3	1	-	4
05	MCA105	Numerical Computation	3	1	-	4
<b>PRACTICAL</b>						
06	MCA191	Programming Lab	-	-	6	3
07	MCA192	Web Technology Lab	-	-	3	2
08	MCA193	Communication Skills Lab	-	-	3	2
<b>TOTAL</b>			-	-	-	<b>27</b>

### SECOND SEMESTER (SPRING)

<b>THEORY</b>						
<b>SL NO</b>	<b>COURSE CODE</b>	<b>SUBJECT</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>CREDIT</b>
01	MCA201	Object Oriented Programming using C++	3	1	-	4
02	MCA202	Operating Systems	3	1	-	4
03	MCA203	Data Structures	3	1	-	4
04	MCA204	Computer Communication Networks	3	1	-	4
05	MCA205	Discrete Mathematics	3	1	-	4
<b>PRACTICAL</b>						
06	MCA291	C++ Lab	-	-	3	2
07	MCA292	Data Structures Lab	-	-	6	3
08	MCA293	Soft Skills Lab	-	-	3	2
<b>TOTAL</b>			-	-	-	<b>27</b>

### THIRD SEMESTER (AUTUMN)

<b>THEORY</b>						
<b>SL NO</b>	<b>COURSE CODE</b>	<b>SUBJECT</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>CREDIT</b>
01	MCA301	Data Base Management System	3	1	-	4
02	MCA302	Design and Analysis of Algorithms	3	1	-	4
03	MCA303	Object Oriented Analysis & Design using UML	3	1	-	4
04	MCA304	Internet Web Technology	3	1	-	4
05	MCA305	Operations Research	3	1	-	4

<b>PRACTICAL</b>						
06	MCA 391	Database Lab	-	-	6	3
07	MCA 392	Programming Lab using JAVA	-	-	6	3
08	MCA 393	Mini Project	-	-	-	2
<b>TOTAL</b>			-	-	-	<b>28</b>

#### **FOURTH SEMESTER (SPRING)**

<b>THEORY</b>						
<b>SL NO</b>	<b>COURSE CODE</b>	<b>SUBJECT</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>CREDIT</b>
01	MCA401	Software Engineering	3	1	-	4
02	MCA402	Computer Graphics and Animations	3	1	-	4
03	MCA403	Organizational Behavior	3	1	-	4
04	MCA404	Enterprise Computing	3	1	-	4
05		Elective-I	3	1	-	4
<b>PRACTICAL</b>						
06	MCA 491	Enterprise Computing Lab	-	-	6	3
07	MCA 492	Computer Graphics and Animations Lab	-	-	3	2
08	MCA 493	Professional Communication Lab	-	-	3	2
<b>TOTAL</b>			-	-	-	<b>27</b>

#### **FIFTH SEMESTER (AUTUMN)**

<b>THEORY</b>						
<b>SL NO</b>	<b>COURSE CODE</b>	<b>SUBJECT</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>CREDIT</b>
01	MCA501	Artificial Intelligence	3	1	-	4
02	MCA502	Cryptography and Network Security	3	1	-	4
03	MCA503	Management Support Systems	3	1	-	4
04		Elective-II	3	1	-	4
05		Elective-III	3	1	-	4
<b>PRACTICAL</b>						
06	MCA 591	Artificial Intelligence Lab	-	-	6	3
07		Elective –III Lab	-	-	6	3
<b>TOTAL</b>			-	-	-	<b>26</b>

## SIXTH SEMESTER (SPRING)

The entire sixth semester is devoted to practice orientation and training. During the semester students have to undertake compulsory project oriented training for 120 days and submit a project report based on the work done for evaluation.

<b>SESSIONALS</b>						
<b>SL NO</b>	<b>COURSE CODE</b>	<b>SUBJECT</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>CREDIT</b>
01	MCA681	Seminar	-	-	-	4
02	MCA682	Project Work	-	-	-	12
03	MCA683	Viva Voce	-	-	-	4
<b>TOTAL</b>			-	-	-	<b>20</b>

### **ELECTIVE-I :**

MCA411	Mobile Computing
MCA412	Advanced Computer Architecture
MCA413	Digital Image Processing
MCA414	Data Warehousing and Mining
MCA415	Bio-informatics
MCA416	Distributed Systems
MCA417	Software Project Management
MCA418	Human Computer Interaction

### **ELECTIVE-II :**

MCA511	Parallel and Distributed Algorithms
MCA512	Theory of Computation
MCA513	Distributed Database Management
MCA514	Performance Evaluation and Reliability of Information Systems
MCA515	Software Configuration Management
MCA516	Real Time Systems
MCA517	Embedded Systems

### **ELECTIVE-III -THEORY :**

MCA522	Soft Computing
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MCA523	Advanced Database
MCA524	Visual Computing
MCA525	Multimedia & Animations
MCA526	Enterprise Resource Planning
MCA527	Simulation and Modeling

**ELECTIVE-III - PRACTICAL :**

MCA592	Soft Computing Lab
MCA593	PL/SQL Lab
MCA594	Visual Computing Lab
MCA595	Multimedia & Animations Lab
MCA596	Enterprise Resource Planning Lab
MCA597	Simulation and Modeling Lab

## DETAILED SYLLABI

### SEMESTER-1

#### MCA101 PROGRAMMING METHODOLOGY

**General Problem Solving Concepts**-Types of problems, problems solving with computers, difficulties with problem solving, Problem Solving Aspects, Problem Solving Concepts for computer- constants and variables, data types, functions, operators, expressions and equations, Programming Concepts – communicating with computers, organizing the problem, using the tools, testing the solution, coding the program, Top down design.

**Introduction to programming structure**- Pointer for structuring the program, modules and their function cohesion & Coupling, Local and global variable, parameters, return values, variable names and data dictionaries, Problem solving with sequential logic structure, Solution development, Problem solving with decision- Logic structure, multiple if-then-else using straight through logic using positive & negative logic, logic conversion, decision tables.

**Fundamental algorithms**– Exchanging Values of two variables, Counting, summation of set of numbers, factorial computation, sine function computation, Fibonacci series, reverse of digit, BCD conversion, Char to number conversion), Factoring methods - Square root of number, smallest divisor, GCD of two number, prime number, prime factors of integer, pseudo random number generation.

**Processing Array**– One dimensional, multidimensional arrays, table lookup technique, the pointer technique, Array Techniques – Array order reversals, array counting, and finding maximum number in a set, Partitioning of array, finding smallest element, searching an array for a range.

**Text processing Technique**- Text Line Length Adjustment, Left and right justification of text, keyword searching in text, text line editing, Pattern searching -linear pattern search, sub linear pattern search.

**Concept of object oriented programming**– Objects, classes, Methods, Abstraction, Inheritance, Encapsulation, Understanding public, private, protected access, Constructor, Destructor, Implementation of above concepts using of C++.

#### Reference Books

1. Maureen Spankle, Problem Solving and Programming Concepts, Pearson Education.
2. Ravi Sethi , Programming Language, Pearson Education.
3. Kanneth C. Louden - Programming Language Principles & Practice, Cengage Learning.
4. Seyed H. Roosta, Programming language Design & Implementation, Cengage Learning.

## MCA102 COMPUTER ARCHITECTURE

**Basic Concepts:** Error detection and correction codes, combinational circuits, sequential circuits, flip-flops, shift registers, counters

**Principles of Computer design:** Von neuman Architecture. Register transfer micro operation, Central processing unit, machine language instructions, Addressing modes, instructions types, instruction sets, instruction cycle & execution cycle, pipelining in CPU design.

**Memory System:** Storage technologies, Memory array organization, Memory hierarchy, interleaving cache & virtual memories & architectural aids to implement these.

**I/O devices & characteristics:** I/O processing, bus interface, data transfer techniques, I/O interrupts, DMA.

**INTEL 8086:** Register Organization, Architecture, Signal Descriptions of 8086 -Minimum Mode and Maximum Mode, Instruction Formats, Addressing Modes, Instruction Set, Assembler Directives, Assembly language programs.

### Reference Books:

1. M. Morris Mano, Computer System Architecture, Pearson Education
2. Douglas V. Hall, Microprocessors and Intel-Programming and Hardware, TMH.
3. Lance A. Leventhal, Introduction to Microprocessors: Software, Hardware, programming PHI.
4. Yu-Cheng Liu and Glenn A. Gibson, Microcomputer Systems-The 8086/8088 family-Architecture, Programming and Design, PHI.
5. Mohammed Rafiquezzaman, Microprocessors Theory & Application: Intel & Motorola, PHI.

## MCA103 ACCOUNTING & FINANCIAL MANAGEMENT

**Meaning and Scope of Accounting :** Definition and Functions of Accounting, Book Keeping and Accounting, End users of Accounting Information, Branches of Accounting, Objectives of Accounting.

### **Accounting Principle**

Meaning of Accounting Principles, Accounting Principles, Accounting Concepts, Accounting Conventions, Systems of Book Keeping, Systems of Accounting.

### **Basic Accounting Terms**

Assets, Liabilities, Capital, Revenue, Expenditure, Debtor, Creditor, Accounts receivable, Accounts Payable, Gross profit, Net Profit/Income, Working Capital.

### **Journalizing Transactions, Ledger, Trial balance**

Journal, Rules of Debit and Credit, Ledger Posting and Trial Balance

### **Final Accounts**

Trading Account, Profit and Loss Account, Manufacturing Account, Balance Sheet, Adjustment Entries.

### **Nature and scope of management accounting**



Meaning of Management Accounting, Functions of Management Accounting, Scope of Management Accounting, Utility of Management Accounting.

### **Financial Statement Analysis and Interpretation**

Types of Financial Statements, Analysis and Interpretation of Financial Statements, Steps involved in Financial Statement Analysis, Ratio Analysis.

### **Funds Flow Statement and Cash Flow Statement**

Funds Flow Statement, Uses of Funds Flow Statement, Preparation of Funds Flow Statement, Cash Flow Statement, Preparation of Cash Flow Statement, Sources of Cash, Utility of cash Flow Analysis.

### **Nature of Financial Management**

Finance and related disciplines, Scope of Financial Management, Objectives of Financial Management, Basic Financial Concepts, Time value of money, Valuation of Long Term Securities, Risk and Return

### **Financing Decision**

Nature of Capital Budgeting, Evaluation Techniques, Concept and Measurement of Cost of Capital, Capital Structure Theories, Net Income Approach, Net Operating Income Approach, MM Approach, Traditional Approach.

### **Dividend Policy Decisions**

Dividend and Valuation, Irrelevance of dividends, Modigliani and Miller Hypothesis, Determinants of Dividend Policy.

### **Current Asset Management**

Theory of Working Capital management, Nature of Working Capital, Determining Financing Mix, Planning of Working Capital, Determinants of Working Capital, Computation of Working capital.

### **Reference Books:**

1. S. N. Maheswari and S. K. Maheswari, Introduction to Accountancy, Vikas Publication.
2. M. Y. Khan and P. K. Jain, Financial Management, TMH.
3. Prasana Chandra, Financial Management, TMH.

## **MCA104 INFORMATION SYSTEMS**

**Foundation of Information Systems:** Introduction to information system in business, fundamentals of information systems, Solving business problems with information systems, Types of information systems, Effectiveness and efficiency criteria in information system.

**An overview of Management Information Systems:** Definition of a management information system, MIS versus Data processing, MIS & Decision Support Systems, MIS & Information Resources Management, End user computing, Concept of an MIS, Structure of a Management information system.

**Concepts of planning & control:** Concept of organizational planning, The Planning Process, Computational support for planning, Characteristics of control process, The nature of control in an organization.

**Business applications of Information Technology:** Internet & electronic commerce, Intranet, Extranet & Enterprise Solutions, Information System for Business Operations, Information System for Managerial Decision Support, Information System for Strategic Advantage.

**Managing Information Technology:** Enterprise & global management, Security & Ethical challenges, Planning & Implementing changes.

**Advanced Concepts in Information Systems:** Enterprise Resource Planning, Supply Chain Management, Customer Relationship Management, and Procurement Management.

### **Reference Books:**

1. O. Brian, Management Information System, TMH.
2. O. Brian, Introduction to Information System, TMH.
3. Gordon B. Davis & Margrethe H. Olson, Management Information System, TMH.
4. Murdick, Information System for Modern Management, PHI.
5. Jawadekar, Management Information System, TMH.
6. Jain Sarika, Information System, PPM.
7. Davis, Information System, Palgrave Macmillan.

## **MCA105 NUMERICAL COMPUTATIONS**

**Approximation and Error:** Fixed point arithmetic, rounding error, truncation error, loss of significance and error propagation, condition and stability, computational methods for error estimation, convergence of sequences, some mathematical preliminaries.

**Roots of  $f(x)$ :** By bisection method, method of false position, secant method, fixed point iteration method.

**System of linear Equation:** Solution of simultaneous linear equations by Cramer's rule, Gauss-Seidel method, matrix inversion by Gauss-Jordan method.

**Eigen value problem:** Computing eigen value and eigenvectors, Determination of eigen values and eigen vectors of a matrix by iteration.

**Curve Fitting:** Least square approximation of functions by linear regressing, polynomial regression.

**Interpolation:** Newton's forward and backward interpolation formulae, Lagrange's interpolation formula, divided differences, Newton's divided difference formula, piecewise polynomial methods.

**Numerical differentiation and integrations:** Differentiation formulae, integration by trapezoidal rule, Simpson's 1/3 rule and 3/8 rule, Gaussian quadrature formula.

**Numerical solution of Ordinary Differential equation:** Euler's method. Modifications of Euler's method, Runge-Kutta methods of the 2<sup>nd</sup> and fourth order, predictor-corrector methods.

### **Reference Books:**

1. Cheney, Numerical Mathematics & Computing, Cengage Learning.
2. Kendall Atkinson, Elementary, Numerical Analysis 2<sup>nd</sup> Edn., John Wiley.
3. S.C. Chopra and R. P. Canale, Numerical Methods for Engineers, TMH.
4. C.F.Gerald, P.O.Wheatley Applied Numerical Analysis, Pearson Education.

5. Burden, Numerical Analysis, Cengage Learning.
6. Jain, Iyengar & Jain, Numerical methods for Scientific & Engineering Computation, New Age Publisher.

## **PRACTICALS**

### **MCA 191 Programming Lab**

Directory structures, file permissions, creating and editing simple C programme, compilation and execution.

C programming on variables and expression assignment, simple arithmetic

Loop, if-else, Case statement, break, continue, go to

Single & Multidimensional arrays

Functions, recursion, file handling in C

Pointers, address operator, declaring pointers and operations on pointers

Address of an array, structures, pointer to structure, dynamic memory allocation.

### **MCA 192 Web Technology Lab**

Web Programming Concepts, introduction to HTML, Advance HTML: Frame, Link, Table handling, and creating forms in HTML, introduction to DHTML.

Introduction to Java script, The Java script document object model.

XML-Purpose and nature, Syntax and structure rules, Document type declaration, Data binding, linking mechanisms.

### **MCA 193 COMMUNICATION SKILLS LAB**

#### **Listening**

Ice-breaking & Language games

Listening practice

Ear-training / Loud Reading

#### **Pronunciation**

Pronunciation practice for problem sounds

(Accent Neutralization)

Practicing Weak & Strong forms

Practicing Stress & Intonation

#### **Grammar in Use**

Usage practice: State & Event verbs

Practice with Tense/Phrasal Verbs/Negation

Interrogation practice

### **Written Communication**

Note-making & Summarizing

Letter writing & Report making

Paragraph development

### **Reference Books:**

1. Doff & Jones, Language in Use, Cambridge
2. Raman & Sharma, Technical Communication, Oxford
3. J D O'Connor, Better English Pronunciation, UBI

## **SEMESTER-2**

### **MCA 201 OBJECT ORIENTED PROGRAMMING USING C++**

**Fundamentals of OOPS and C++:** OOP's concept, Programming Paradigm, Introduction to C++, Preprocessor directive, main method, namespace 'std', Constants, variables, Flow controls, functions and standard classes.

**Input and Output with Streams:** Streams, Formatting and Manipulators, Output in Fields, Formatted Input, Unformatted Input/Output

**References, Pointers and Arrays:** References, references as parameters, references as return values, pointers, indirection operators, Arrays.

**Classes and Objects:** Structures in C++, Classes, Public, Private, Protected keywords, member functions, data encapsulation, Static member variables, static member functions, static objects, friend functions and friend classes.

**Constructors and Destructors:** Constructors, Constructors with arguments and default, overloading constructors, copy constructors, 'const' objects, Destructors, calling Constructors and Destructors

**Operator Overloading:** Introduction, 'keyword' operator, Overloading Unary and Binary Operators, Overloading with Friend Function.

**Inheritance:** Access specifier and simple inheritance, Public and Private inheritance, Inheritance Types, Virtual Base Class, Constructors, Destructors and Inheritance.

**Polymorphism and Virtual Functions:** Binding, Virtual Functions, Abstract Classes, Object Slicing, Virtual destructors

**Exception Handling:** Try, throw and catch, multiple exceptions, re throwing exceptions, terminate(), set\_terminate(). Exception and operator overloading, Exception and inheritance

**Fundamentals of File Input and Output:** Files, Streams, Open modes, closing files, reading and writing blocks, object persistence.

**Templates:** Functions and Class Templates, Template Instantiation, Template parameters, Arguments.

### **Reference books:**

1. Herbert Schildt, C++, The Complete Reference, TMH

2. K R Venugopal, Mastering C++, TMH
3. Balguruswamy, Object Oriented Programming with C++, TMH
4. Kamthane, Object Oriented Programming with ANSI & Turbo C++, Pearson Education

### **MCA202 OPERATING SYSTEMS**

**Introduction:** Evolution of operating systems. Types of operating systems, Different views of the operating systems, Operating system concepts and structures.

**Processes:** The process concept, system programmers' view of processes. The operating systems' view of processes, Operating system services for process management, scheduling algorithms, Performance evaluation.

**Inter-process Communication and Synchronization:** The need for inter-process synchronization, Mutual exclusion, Semaphores, Classical problems in concurrent programming, Critical region, Monitors.

**Deadlock:** Deadlock criteria, prevention, avoidance, detection and recovery algorithms.

**Memory Management:** Contiguous memory allocation, Swapping, paging and segmentation, virtual memory, Page replacement algorithms. Design issues for paging systems, Segmentation.

**File Systems:** File systems, Directories, File system implementation, Security & protection mechanisms.

**Principles of I/O Hardware and software :** I/O devices, Device controllers, Principles of I/O Software, Interrupt handlers, Device drivers, Device independent I/O software, User space I/O software.

**Disks:** Disk hardware, scheduling algorithms, Error handling, track-at-a-time caching, RAM Disks.

**Clocks:** Clock hardware, Clock software.

**Terminals:** Terminal hardware & software, Memory-mapped terminals, I/O Software.

### **Reference Books:**

1. Silberschatz & Galvin, Operating system concepts, John Wiley & Sons.
2. D. M. Dhamdhere , Operating System, TMH
3. P. C. Bhatt, An Introduction to Operating Systems: Concepts & Practice, PHI
4. Milan Milenkovic, Operating System Concept and Design, TMH
5. Tanenbaum, Operating System Design & Implementation, Pearson Education.
6. Deitel, Operating System, Pearson Education.

### **MCA 203 DATA STRUCTURES**

**Development of Algorithms:** Notations and Analysis. Storage structures for arrays- sparse matrices- structures and arrays of structures. Stacks and Queues: Representations and applications.

**Linked Lists:** Singly linked lists, Linked stacks and queues, Operations on Polynomials, Linked Dictionary, Doubly Linked Lists, Circular Linked Lists. Dynamic Storage Management, Garbage collection and compaction.

**Binary Tress:** Binary search Trees, General Trees, Tree Traversing, Operations on Binary Trees, Expression Manipulations, Symbol Table construction, Height Balanced Trees.

**Graphs:** Representation of Graphs - BFS, DFS

**Sorting Techniques:** Selection, Bubble, Insertion, Merge, Heap, Quick, Radix and address calculation, linear searching, Binary Searching, Hash Table Methods.

### **Reference Books:**

1. Gilberg & Forouzan, Data Structures with C, Cengage Learning.
2. Mark Allen Weiss, Data Structure and Algorithm Analysis in C, Pearson Education.
3. Kruse, Data structures and Program Design in C, Pearson Education
4. Langsam, Tanenbam , Data Structures using C & C++, Pearson Education
5. Goodrich et.al, Data Structures & Algorithms in C++, John Wiley.
6. Lipschutz & Pai, Data Structures, TMH

## **MCA 204 COMPUTER COMMUNICATION NETWORKS**

### **Introduction:**

Introduction and evolution of network, Importance of network, Data and Signal, Data Communication, Networks, protocols and standards, Point to Point and Multipoint Line Configuration, Network Topologies Mesh, Star, Tree, Bus, Ring, Transmission modes: Simplex, Half Duplex, Full Duplex. The OSI Model Functions of the layers, TCP/IP Protocol Suite, Network layer, addressing, Sub netting and Super netting, Transport layer and Application Layer,

**Signals:** Analog and digital signals, Periodic and Aperiodic signal, Time and frequency domains, Frequency Spectrum and Bandwidth, Decomposition of a digital signal. Encoding and modulating:

Digital to digital conversion: Unipolar, Polar, Bipolar, Analog to digital conversion: PAM, PCM, Digital to analog conversion: ASK, FSK, PSK, QAM and Analog to analog conversion : AM, FM, PM.

### **Transmission of Digital Data:**

Parallel and serial transmission, DTE - DCE interface, Modems, Guided and unguided transmission media, Parallel and serial transmission, DTE - DCE interface, Modems, Guided and unguided transmission media, Transmission Impairment , Performance, Multiplexing, Frequency division, wave division and time division multiplexing. Error Detection and Correction: Types of errors, Redundancy Checks (VRS, LRC, CRC), Error Correction.

**Data Link Control:** Line discipline, Flow Control, Error Control Data Link Protocols: Asynchronous and Synchronous Protocols, Character and Bit Oriented Protocols (HDLC, PPP Protocols)

**Local Area Network :** IEEE 802 standards, Ethernet, Token Bus, Token Ring

**FDDI. Switching:** Circuit Switching, Packet Switching. Integrated Services Digital Network (ISDN): Services, History, Subscriber Access to ISDN, the ISDN Layers, Broadband ISDN. X.25-Layers, Protocols related to X.25. Congestion Control.

**Networking and Internetworking Devices:** Repeaters, Bridges, Routers, Gateways, Routing Algorithms, Client- Server Model, DHCP, Telnet, DNS, FTP, SMTP, SNMP, HTTP, World Wide Web.

### **Reference Books:**

1. Foruzan, Data Communications and Networking, TMH.
2. Tannenbaum, Computer Networks, Pearson.
3. Stallings, Computer Communication Networks, Pearson.
4. Scheweber, Data Communication, TMH.
5. Stevens, TCP/IP Illustrated, Vol. 1 - The Protocols, Addison-Wesley Professional.
6. Black, Computer Networks - Protocols, Standards and Interfaces, PHI.

## **MCA205 DISCRETE MATHEMATICS**

**Logic, Sets and Functions:** Foundation of logic, propositional equivalence, Predicates and quantifiers, methods of proof, sets and set operations, functions.

**Boolean Algebra:** Basic definitions, Sum of Products and Product of Sums, Form in Boolean Algebra, Logic-gates and Karnaugh-maps.

**Algorithms, Integers and Matrices:** Introduction to algorithms, the growth of functions, complexity of algorithms, the integers and division, integers and algorithms, matrices.

**Mathematical Induction and Recursion:** Methods of proof, mathematical induction, recursive definition, recursive algorithms.

**Counting:** The basics of counting, the pigeonhole principle, permutations and combination.

**Algebraic Structures:** Definition, Properties, types: Semi Groups, Monoid, Groups, Abelian group, properties of groups, Subgroup, cyclic groups, Cosets, factor group, Permutation groups, Normal subgroup, Homomorphism and isomorphism of Groups, example and standard results, Rings and Fields: definition and standard results.

**Relations:** Relations and their properties, recurrence relations, inclusion-exclusion, representing relations, equivalence relations, Generating functions.

**Graphs:** Introduction to graphs, graph terminologies, representing graphs, graph isomorphism connectivity, Euler and Hamilton paths, shortest- path problem.

### **Reference Books:**

1. Kenneth H. Rosen, Discrete Mathematics and its Applications, TMH.
2. Richard Johnsonbough, Discrete Mathematics, Pearson Education.
3. Kolman, Busby and Ross, Discrete Mathematical Structure, PHI.
4. Truss, Discrete Mathematics for computer scientists, Pearson Education.
5. Koshy, Discrete Mathematics with Applications, Elsevier.

## **PRACTICALS**

### **MCA291 C++ Lab**

**C++:** Token, Expressions, Control Structure, Function Prototyping call by reference, Return by reference, inline functions, Default arguments, classes, Objects, Memory allocation for objects, static data members

and function member, Friend function, Constructors, Destructors, Operator overloading type conversion, Inheritance, Virtual base class, Abstract class, Use of this pointer virtual function, Opening and closing of files, Accessing of file, Template Function, Temple class, Exception handling.

### **MCA292 DATA STRUCTURES LAB**

**Stack:** Problems of stack, evaluation of Arithmetic expressions in infix, prefix, and postfix forms.

**Queue:** Problems on queue, circular queues, insertion and deletion on queues.

**List:** Problems on single linked list, doubly linked list with list operations, circular list.

**Trees:** Creation of Binary tress, determination of depth of binary tree, counting nodes, tree traversals, balanced tree.

**Graphs:** Problems on graphs, Breadth First Search, Depth First Search.

**Heaps:** Problems on Heaps, Operations on heaps, Heap Sort, Priority Queues.

**Searching and Sorting algorithm:** Problems on Binary Search, selection sort, Quick sort, Bubble sort, merger sort.

### **MCA 293 SOFT SKILLS LAB**

#### **Personality Development**

1. Time Management
2. Psychometrics
3. Emotional Intelligence & Lateral Thinking
4. Stress Management
5. External Personality

#### **Presentation Skills**

1. Elements of Effective Presentations
2. Structure of Presentation
3. Body Language & Voice Modulation
4. Presentation Tools: Application
5. Issues & Solutions

#### **Public Speaking**

1. Speaking Basics
2. 7 Ps of Public Speaking
3. Confidence Enhancement
4. Tips & Tricks
5. Crisis Management

#### **Reference Books:**

1. Brian Clegg, Crash Course in Personal Development, Kogan Page
2. John Seely, Oxford Guide to Writing and Speaking, Oxford



## SEMESTER-3

### MCA 301 DATA BASE MANAGEMENT SYSTEMS

**Basic Concepts:** Database & Database users, Characteristic of the database, database systems, Concepts & Architecture, Data models, schemas & instances, Data independence, Database languages & interfaces.

**ER, EER & Relational Concepts:** Data modeling using the entity relationship approach, Enhanced entity relationship approach, Relational Concepts & Relational database constraints, Database design using ER, EER to Relational mapping.

**Relational Model, Languages & Systems:** Relational data model, Relational algebra , SQL- a relational database language, Data definition, View & Data Manipulation in SQL, relational database management systems using ORACLE/Relational Calculus.

**Relational Database Design:** Functional dependencies & Normalization for relational databases, Normal forms based on primary keys (1-NF, 2-NF, 3-NF & BCNF), Loss Less join & dependency preserving decomposition, multi valued dependency & 4NF, Join dependency & 5NF, Algorithms.

**Concurrency control & Recovery Techniques:** Concurrency control techniques, locking techniques, time stamp ordering, granularity of data items, recovery techniques, recovery concepts, database backup and recovery from catastrophic failures.

#### Reference Books:

1. Elmasri, Navathe, Fundamentals of Database Systems , Pearson Education.
2. Silbersetatz, Korth, Sudarshan , Database system concepts. TMH.
3. Thomas Connolly, Carolyn Begg, Database Systems – A Practical Approach to Design, Implementation and Management. , Pearson Education.
4. Bipin. C. Desai, Database Management., Galgotia Publication.
5. Leon and Leon, Database Management System, Vikash Publication.
6. Raghu Ramakrishnan and Johannes Gehrke, Database Management Systems, TMH.

### MCA 302 DESIGN AND ANALYSIS OF ALGORITHMS

**Introduction:** Growth of Functions, Asymptotic notations Recurrences, Recurrence tree and the master method. Application to Analysis of Heap Sort, Priority-Queues.

**Divide and conquer algorithms:** (Analysis of merge sort, quick sort and heap sort algorithms), Priority queue, Data structure for disjoint sets (Disjoint set operations, linked list representation, disjoint sets)

**Dynamic programming:** Matrix chain multiplication, Longest Common Subsequences

**Greedy Method:** Huffman Codes, Concept of Backtracking .

**Graph Algorithms:** Minimum spanning tree (Algorithm of Kruskal & Prim), Single source shortest paths (Dijkstra's Algorithm), All pairs shortest paths (Floyd-Warshall algorithm)

**NP-Completeness & Approximation Algorithms:** Polynomial Time, Polynomial-Time certification, NP-Completeness, NP Completeness and Reducibility, NP-Complete problems :The circuit satisfiability problem, The clique problem, The vertex-cover problem, The subset sum problem ,Algorithm for Traveling-Salesperson Problem.

### **Reference Books:**

1. T.H Cormen C. E. Leiserson, R. L. Rivest, Introduction to Algorithms, Prentice Hall of India.
2. Dasgupta, Papadimitriou & Vazirani, Algorithms, TMH.
3. E.Horwitz S.Sahani, S.Rajasekharn, Fundamentals of Computer Algorithms, University Press.
4. Michael T. Goodrich, Algorithm Design: Foundations, Analysis & Internet examples, John Wiley.
5. Aho, Hopcroft, Ullman, The Design & Analysis of Computer Algorithms, Addison Wesley Longmans.
6. S.Baase & A.V.Gelder, Computer Algorithms-Introduction to Design & Analysis, Pearson Education.
7. Goodman, Introduction to the Design & Analysis of Algorithm, TMH.

## **MCA-303 OBJECT ORIENTED ANALYSIS & DESIGN USING UML**

**Introduction to UML:** Importance of modeling, principles of modeling, object oriented modeling, conceptual model of the UML, Architecture.

**Basic Structural Modeling:** Classes, Relationships, common Mechanisms, and diagrams.

**Advanced Structural Modeling:** Advanced classes, advanced relationships, Interfaces types and roles, Packages.

**Class & Object Diagrams:** Terms, concepts, modeling techniques for Class & Object Diagrams.

**Basic Behavioral Modeling-I:** Interactions, Interaction diagrams.

**Basic Behavioral Modeling-II:** Use cases, Use case Diagrams, Activity Diagrams.

**Advanced Behavioral Modeling:** Events and signals, state machines, processes and Threads, time and space, state chart diagrams.

**Architectural Modeling:** Component, Deployment, Component diagrams and Deployment diagrams.

### **Reference Books:**

1. Grady Booch, James Rumbaugh, Ivar Jacobson: The Unified Modeling Language User Guide, Pearson Education.
2. Hans-Erik Eriksson, Magnus Penker, Brian Lyons, David Fado: UML 2 Toolkit, WILEY-Dreamtech IndiaPvt. Ltd.
- 3.Meilir Page Jones, Fundamentals of Object Oriented Design in UML, Pearson Education.

4. Atul Kahate, Object Oriented Analysis & Design, TMH.
5. Craig Larman, Applying UML and Patterns: An introduction to Object – Oriented Analysis and Design and Unified Process, Pearson Education.

### **MCA304 INTERNET TOOLS AND APPLICATION**

**An Overview of Java:** Data Types, Variables, and Arrays, Operators, Control Statements.

**Introducing Classes:** Methods, Inner Classes, Packages, Strings, Inheritance & Polymorphism, Abstract class, Interfaces, Exception Handling.

**Java I/O:** Input Stream, Output Stream, File Stream.

**Multithreaded Programming:** Multithreading concepts, Thread Life cycle, Creating multithreaded application, Thread priorities, Thread synchronization.

**Networking with Java:** Networking basics, Sockets, port, java.net – networking classes and interfaces, Implementing TCP/IP based Server and Client, Datagrams – Datagram packet, Datagram server and client.

**Applets:** Applet Architecture, Applet Initialization and Termination, Simple Applet Display Methods, Requesting Repainting.

**AWT & Event Handling:** Layout Managers, Border layout, Flow layout, Grid layout, Card layout, AWT all components, Event delegation Model, Event source and handler, Event categories, Listeners, interfaces, Anonymous classes.

**Swings :** Model view Controller design pattern, Different layout, Menus, Dialog boxes, Text input etc.

**Database Connectivity With Jdbc:** Java database connectivity, Types of JDBC drivers, Writing first JDBC applications, Types of statement objects (Statement, Prepared Statement and Callable Statement), Types of resultset, ResultSet Metadata, Inserting and updating records, JDBC and AWT, Connection pooling,

### **Reference Books:**

1. Cay S Horstmann, Fary Cornell, Core Java 2 Volume – I, Java series of Sun Microsystems Press, PHI.
2. Cay S Horstmann, Fary Cornell, Core Java 2 Volume – II, Java series of Sun Microsystems Press, PHI.
3. E.Balguruswami , Programming with Java - A Primer, TMH.
4. James Goodwill , Developing Java Servlets, SAMS
5. Jim Keogh, Complete Reference- J2EE, TMH
6. Patric Naughton, Herbert Schildt, Java 2 Complete Reference, TMH

### **MCA305 OPERATIONS RESEARCH**

**Linear programming:** Modeling of linear programming, graphical method for two dimensional problems Simplex method of LPP in standard form . Artificial variable technique- two-phase method, Big M-method, degeneracy, unbounded solution, infeasible solution.

**Sensitivity analysis and dual problem:** Definition of the dual problem, the relationship between the optimal primal and dual solution, the dual Simplex method, sensitivity analysis.

**Special Type of linear programming problem:** Transportation problem and its solution, assignment problem, and its solution by Hungarian method.

**Integer Programming:** Introduction technique, binary integer programming, BIP applications & formulations Branch & bound techniques & its applications to BIP, Branch & bound algorithm for mixed integer programming.

**Introduction to Game Theory:** Introduction, Two-Person Zero-sum Games, The Maximin-Minimax principle, Games without Saddle point (Mixed Strategies), Graphical Method for  $2 \times n$  or  $m \times 2$  Games, Dominance Property.

**Dynamic Programming:** Deterministic & Probabilistic dynamic programming.

**Queueing Theory:** Discrete time process, Introduction, formal definition, steady state probabilities, classification terminology, transient processes, Characteristics of Queueing system steady state  $M/M/1$ ,  $M/M/1/k$  and  $M/M/C$  queueing models, Birth & Death Process.

**PERT and CPM:** Arrow networks-time estimate earliest expected time, latest allowable occurrence time and slack, critical path probability of meeting scheduled date of completion of project, calculations or CPM network, various floats for activities, critical path, updating project time cost trade off curve-selection of schedule based on cost analysis.

**Reference Books:**

1. Hillier and Lieberman, Introduction to Operations Research, TMH.
2. H. Taha, Operations Research, Pearson Education.
3. P.K.Gupta & Hira, Operations Research, S. Chand.
4. J. K.Sharma, Operations Research, McMillan
5. Winston, Operations Research: Applications & Algorithms, Cengage Learning.
6. Kanti Swarup, Gupta, P.K.and ManMohan Operations Research, Sultan Chand & Sons.

**PRACTICALS**

**MCA 391 DATABASE LAB**

Study features of a commercial RDBMS package such as Oracle and Structured Query Language (SQL). Laboratory exercises should include defining schemes for the applications, creation of a database, writing SQL queries to retrieve and manipulate data from the database. Use of host language interface with embedded SQL.

**MCA 392 JAVA Lab**

An overview of JAVA, Data types, variable and arrays, Operators, Control statements, Introducing classes, Methods, Inheritance, Packages and interfaces, Exception handling Applets, JDBC.

**SEMESTER - IV**

**MCA401 SOFTWARE ENGINEERING**

**Introduction to Software Engineering:** Emergence of Software Engineering, Changes in Software Development Practices, System Engineering, Role of System Analyst.

**Software Life Cycle Models:** Need for a life cycle model, Phase Entry and Exit Criteria, Classical Waterfall Model, Iterative Waterfall model, Iterative Waterfall Model, Prototype Model, Evolutionary Model, Spiral Model, Selection criteria for the various models, Agile model development.

**Requirement Analysis and Specification:** Requirement Gathering and Analysis, Functional Requirements, Organization of the SRS document, Decision Trees and Decision Tables, Formal System Specification, Axiomatic Specification, Algebraic Specification, 4GL.

**Introduction to Design:** Importance of design, Design activities and methodologies, Good design characteristics, Cohesion, Coupling, Layered Modular Design, Fan-in and Fan-out, Approaches to design.

**Function Oriented Design Approach:** Structured Analysis, Data Flow Diagrams, Structured Design, Transform Analysis and Transaction Analysis, Structure Chart.

**Object Oriented Design with UML:** Overview of Object Oriented Concepts, UML (Unified Modeling Language), UML Diagrams for Users View, Structural View, Behavioral View, Implementation View and Environmental View. Designing Use Case Diagram, Class Diagram and Sequence Diagram.

**Coding:** Coding Standards, Code Walkthrough, Code Inspection, Documentation – Internal and External Documentation, Gunning’s Fog Index.

**Testing:** Validation and Verification, Fault and Failure, Debugging, Debugging Approaches, Unit Testing, Black Box testing, Equivalence Class Partitioning, Boundary Value Analysis, White Box Testing, Integration testing, System Testing – Alpha, Beta and Acceptance Testing, Stress Testing, Regression Testing.

**Maintenance:** Characteristics of Maintenance, Types of Maintenance, Software Reverse Engineering, Maintenance Process Model, Maintenance Cost Estimation.

**Reliability and Quality Management:** Introduction to Reliability, Reliability Metrics, Reliability Growth Modeling, Software Quality, ISO 9001, SEI CMM, Six Sigma.

**Computer Aided Software Engineering:** Scope of CASE, Benefit of CASE, CASE in Software Life Cycle, Second Generation CASE Tool, CASE Environment Architecture

### **Reference books:**

1. Ghezzi, Software Engineering, Pearson Education.
2. Pressman R.S, Software Engineering - A Practitioners Approach, TMH.
3. Ian Sommarville, Software Engineering, Pearson Education.
4. Rajib Mall, Software Engineering, PHI.
5. Jalote P, An Integrated Approach Software Engineering, Narosa.

## **MCA402 COMPUTER GRAPHICS & ANIMATION**

**Introduction:** Application areas of Computer Graphics, overview of graphics systems, video-display devices, raster-scan systems, random scan systems, graphics monitors and work stations and input devices

**Output primitives:** Points and lines, line drawing algorithms, mid-point circle and ellipse algorithms. Filled area primitives: Scan line polygon fill algorithm, boundary-fill and flood-fill algorithms.

**2-D and 3D geometrical transforms:** Translation, scaling, rotation, reflection and shear transformations, matrix representations and homogeneous coordinates, composite transforms, transformations between coordinate systems. 3D viewing and General projection transforms (Parallel & Perspective Projections and their Transformations, clipping)

**Viewing and Clipping:** The viewing pipeline, viewing coordinate reference frame, window to view-port coordinate transformation, viewing functions, Cohen-Sutherland and Liang-Barsky line clipping algorithms, Sutherland –Hodgeman polygon clipping algorithm.

**3-D object representation:** Polygon surfaces, quadric surfaces, spline representation, Hermite curve, Bezier curve and B-Spline curves, Bezier and B-Spline surfaces. Basic illumination models, polygon rendering methods.

**Illumination models:** Basic Models, Displaying Light Intensities, halftone patterns and Dithering Techniques

**Visible surface detection methods:** Classification, back-face detection, depth-buffer, scan-line, depth sorting, BSP-tree methods, area sub-division and octree methods.

**Surface Rendering Methods:** Polygon Rendering Methods, Gouraud shading Phong Shading

**Computer animation:** Design of animation sequence, general computer animation functions, raster animation, computer animation languages, key frame systems, motion specifications.

### Reference books:

1. D. Hearn, M.P. Baker - Computer Graphics, Pearson Education.
2. J.D.Foley, V.Dam, S.K.Feiner, J.F.Huges - Computer Graphics Principles Practice, Pearson Education.
3. D. Rogers, Mathematical Elements of Computer Graphics, TMH.
4. D. Rogers, Procedures Elements for Computer, TMH.
5. Plastock, Computer Graphics, (Schaum Outline Series), TMH.
6. Hill, Computer Graphics using open GL, Pearson Education.
7. Plastock, Ccomputer Graphics, TMH.

## MCA403 ORGANIZATIONAL BEHAVIOR

### **Basics of OB:**

- History of OB: Stages of development- Pre-Scientific, Classical, Behavioural, Modern
- Organization structure & process: Components and their interaction
- Approaches: Traditional & Modern: Contributing disciplines
- Emerging Issues: Globalization, Diversity, Demographics, Ethical behaviour

### **The Individual:**

- Personality: Factors (Big Five), Attributes, Measurement (Myers-Briggs Type Indicator)
- Job Attitude: Components, Major attitudes, Job satisfaction & its measurement, Dissatisfaction
- Motivation: Early theories (Need hierarchy & Two-factor) & Recent Theories (ERG & Expectancy)

### **The Group:**

- Groups: Types, Roles, Norms, Size, Group vs. Team, Cohesiveness, Group Decision Making
- Leadership: Theories (Trait, Behavioural & Contingency), Finding and Creating Effective Leaders
- Conflict: Approach, Sources & Negotiation: Stages in the process and remedial strategies

### **The Organization:**

- Structure: Basics, Common Designs: Simple, Bureaucratic and Matrix structures

-Culture: Basics, Functions: Boundary, Identity, Commitment & Stability and Management  
-Change: Agents, Resistance, Management: Lewin's 3-step and Kotter's 8-step models

**Reference Books:**

Robbins, Sanghi & Judge, Essentials of Organisational Behaviour, PHI .  
Kavita Singh, Organisational Behaviour :Text and cases, Pearson Education.  
Fiona Wilson, Organisational Behaviour and Work, Oxford.

**MCA404 ENTERPRISE COMPUTING**

**Distributed Computing**

Custom sockets - Remote Method Invocation - Activation - Object serialization -Distributed garbage collection - RMI - IIOP - Interface definition language - CORBA - JINI overview.

**Client Server Computing**

N-tier architecture, Introduction to MVC, Load-balancing & Clustering, Web-Servers & Application-Servers, Introduction to J2EE APIs

**Java Enterprise Applications**

Servlets - Java Server Pages - JDBC - Session beans - Entity beans - Programming and deploying enterprise Java Beans - Java transactions, JAVA API for XML (DOM, SAX), Web-Services, SOA (Service Oriented Architecture)

**Frameworks & Design-Patterns**

Introduction to Struts, Spring, Hibernate. Creational-Design Patterns, Structural Patterns, Behavioral Patterns

**Reference Books:**

1. Jim Keogh, Complete Reference J2EE , TMH
2. Brett McLaughlin, Building Java Enterprise Applications, O'Reilly
3. Deitel & Deitel, Java How to Program, Prentice Hall.
4. Gary Cornell and Cay S. Horstmann, Core Java Vol 1 and Vol 2, Sun Microsystems Press.
5. Stephen Asbury, Scott R. Weiner, Developing Java Enterprise Applications, Wiley.
6. Gustavo Alonso, Web Services, University Press.

ELECTIVE-I

**MCA411 MOBILE COMPUTING**

**Introduction to Mobile Communications and Computing:** Introduction to Mobile Computing, novel applications, limitations, and architecture.

**GSM:** Mobile services, System architecture, Radio interface, Protocols, Localization and calling, Handover, Security, and New data services.

**(Wireless) Medium Access Control:** Motivation for a specialized MAC (Hidden and exposed terminals, Near and far terminals), SDMA, FDMA, TDMA, CDMA. Spreading techniques

**Mobile Network Layer:** Mobile IP (Goals, assumptions, entities and terminology, IP packet delivery, agent advertisement and discovery, registration, tunneling and encapsulation, optimizations), Dynamic Host Configuration Protocol (DHCP).

**Mobile Transport Layer:** Traditional TCP, Indirect TCP, Snooping TCP, Mobile TCP, Fast retransmit/fast recovery, Transmission /time-out freezing, Selective retransmission, Transaction oriented TCP.

**Database Issues:** Hoarding techniques, caching invalidation mechanisms, client server computing with adaptation, power-aware and context-aware computing, transactional models, query processing, recovery, and quality of service issues.

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

**Mobile Ad hoc Networks (MANETs):** Overview, Properties of a MANET, spectrum of MANET applications, routing and various routing algorithms, security in MANETs.

**Protocols and Tools:** Wireless Application Protocol-WAP. (Introduction, protocol architecture, and treatment of protocols of all layers), Bluetooth (User scenarios, physical layer, MAC layer, networking, security, link management).

### **Reference Books:**

1. Jochen Schiller, Mobile Communications, Pearson Education.
2. Stojmenovic and Cacute, Handbook of Wireless Networks and Mobile Computing, Wiley.
3. Reza Behravanfar, Mobile Computing Principles: Designing and Developing Mobile Applications with UML and XML, Cambridge University Press.
4. Frank Adelstein, Sandeep K.S Gupta, Golden Richard III, Loren Schwiebert, Fundamentals of Mobile and Pervasive Computing, TMH.
5. Uwe Hansmann, Lothar Merk, Martin S, Nicklous, Thomas Stober, Principles of Mobile Computing, Springer.
6. Martyn Mallick, Mobile and Wireless Design Essentials, Wiley.

## **MCA412 ADVANCED COMPUTER ARCHITECTURE**

**Introduction:** Review of basic computer architecture, quantitative techniques in computer design, measuring and reporting performance; CISC and RISC processors,

**Pipelining:** Basic concepts, instructions and arithmetic pipeline, data hazards, control hazards and structural hazards, techniques for handling hazards, Exception handling, pipeline optimization techniques;

**Hierarchical memory technology:** Inclusion, Coherence and locality properties, cache memory organizations, techniques for reducing cache misses, virtual memory organization, mapping and management techniques, memory replacement policies;

**Instruction-level parallelism:** basic concepts, techniques for increasing ILP, super-scalar, super-pipelined and VLIW processor architectures, array and vector processors;

Multiprocessor architecture: Taxonomy of parallel architectures;



**Centralized shared-memory architecture:** Synchronization, memory consistency, interconnections networks, Distributed shared-memory architecture, cluster computers.

**Reference Books:**

1. Hennessy and Patterson, Computer Architecture—A Quantitative Approach, Elsevier.
2. K.Hwang and F.A.Briggs, Computer Architecture and Parallel Processing, TMH.
3. Kai Hwang, Advanced Computer Architecture: Parallelism, Scalability, programmability, TMH.

**MCA413 DIGITAL IMAGE PROCESSING**

**Digital image fundamentals and transforms:** Digital image fundamentals: image digitization, Elements of visual perception sampling and quantization, image resolution, colour perception & processing, image processing: pixel based transformation, geometric transformation, Basic relationship between pixels – Basic geometric transformations-Introduction to Fourier Transform and DFT – Properties of 2D Fourier transform Discrete Cosine Transform, Haar Transform.

**Image enhancement techniques:** Spatial Domain methods: Basic grey level transformation , Histogram equalization , Image subtraction ,Image averaging ,Spatial filtering: Smoothing, sharpening filters , Laplacian filters , Frequency domain filters : Smoothing , Sharpening filters.

**Image restoration:** Model of Image Degradation/restoration process ,Noise models , Inverse filtering ,Least mean square filtering , Constrained least mean square filtering , Blind image restoration , Pseudo inverse , Singular value decomposition.

**Image compression:** Lossless compression: Variable length coding , LZW coding , Bit plane coding-predictive coding-DPCM, Lossy Compression: Transform coding – Wavelet coding , Basics of Image compression standards: JPEG, MPEG, Basics of Vector quantization.

**Image segmentation and representation:** Edge detection , Thresholding ,Region Based segmentation , Boundary representation.

**Reference Books**

1. Rafael C. Gonzalez and Richard E. Woods, Digital Image Processing , Pearson Education.
2. Rafael C. Gonzalez, Richard E. Woods, and Steven Digital Image Processing Using MATLAB, Pearson Education.
3. Anil K Jain Fundamentals of Digital Image Processing , PHI

**MCA414 DATA WAREHOUSING & DATA MINING**

**Introduction of Data Warehouse:** Introduction to Data Warehousing – Batch, OLTP, DSS Applications. Different natures of OLTP and DW databases. Commercial Importance of DW, Data Mart structure, Usage of Data Mart, Security in Data Mart, Data warehouse and Data Mart.

**Basic Elements of Data Warehouse & ETL:** Source System, Data Staging Area, Presentation Server, data Cleaning, Extraction of Data, Transformation of Data, Loading of Data, Practical study of popular ETL tools.

**Modeling:** Dimensional Modeling. Multidimensional Data Model, Data Cubes, OLAP, DW Bus Architecture, Conformed Dimensions, Star Schema and Snowflake Schema, Normalization VS Dimensional Modeling, Slicing and Dicing, Drilling, Drill-up, Drill-down, Drill-within, Drill-across. Bitmap Index, Aggregation & Metadata.

**Introduction to Data Mining:** Basics of data mining, related concepts, Data mining techniques.

**Data Mining Algorithms:** Classification, Clustering, Association rules.

**Web Mining:** Web Content Mining, Web Structure Mining, Web Usage Mining.

**Data Mining Primitives, Languages, and System Architectures:** Data mining primitives, Query language, Designing GUI based on a data mining query language, Architectures of data mining systems.

**Application and Trends in Data Mining:** Applications, Systems products and research prototypes, Additional themes in data mining, Trends in data mining.

**Reference Books:**

1. J. Hahn and Micheline Kamber - Data Mining: Concepts and Techniques, Morgan Kaufmann
2. R. Kimball, Data Warehouse Toolkit, John Wiley
3. A.K. Pujari, Data Mining, University Press
4. Paulraj Ponniah, Data Warehousing Fundamentals, John Wiley.

**MCA415 BIOINFORMATICS**

**Molecular Biology and Biological Chemistry:** The Genetic Material, Gene structure and Information Content, Protein Structure and Function, The nature of Chemical bonds, Molecular Biology Tools, Genomic Information Content, Data Searches and Pairwise Alignments: Dot Plot, Simple Alignments, Gaps, Scoring Matrices, Needleman and Wunsch Algorithm, Global and local Alignments, Database searches, Multiple sequence Alignments, Substitution Patterns: Patterns of substitutions within Genes, Estimating Substitution numbers, Variations in evolutionary rates between Genes, Molecular clocks, evolution in Organelles.

**Distance based methods of Phylogenetics:** History of Molecular Phylogenies, Phylogenetic trees, Distance matrix methods, Maximum likelihood approaches, Multiple sequence Alignments, Character Based methods of Phylogenetics: Parsimony, Inferred ancestral sequences, Strategies for Faster searches, Consensus trees, tree confidence, Comparison of Phylogenetic methods, Molecular Phylogenies.

**Genomics and Gene Recognition:** Prokaryotic genomes, Prokaryotic gene structure, GC-content Prokaryotic genomes, Prokaryotic gene density, Eukaryotic genomes, Eukaryotic gene structure, Open reading frames, GC-content Eukaryotic genomes, Gene expression, Transposition, Repetitive elements, Eukaryotic gene density, Protein and RNA structure prediction: Amino acids, Polypeptide composition, Secondary structure, Tertiary and quaternary structure, Algorithms for Modeling Protein Folding, Structure prediction, Predicting RNA secondary structures, Proteomics: from Genomes to Proteomes, Protein classification, Experimental techniques, Inhibitors and drug design, Ligand screening, X-ray crystal structures, NMR structures, Empirical methods and prediction techniques, Posttranslational modification prediction.

**Reference Books:**

1. Dan E. Krane, Michael L. Raymer, Fundamental Concepts of Bioinformatics, Pearson Education.
2. Teresa Attwood, David Parry-Smith, Introduction to Bioinformatics, Pearson Education.
3. Shuba Gopal, A. Haake, R. P. Jones, P. Tymann, Bioinformatics: A Computing Perspective, TMH.
4. Yi-Ping P. Chen, Bioinformatics Technologies, Springer.
5. Arthur Lesk, Introduction to Bioinformatics, Oxford University Press.
6. Bryan Bergeron, Bioinformatics Computing, PHI.
7. Zoe Lacroix, Terence Critchlow, Bioinformatics: Managing Scientific Data, Elsevier.

## **MCA416 DISTRIBUTED SYSTEMS**

**Characterization of Distributed Systems:** Introduction, Examples of distributed Systems, Resource sharing and the Web Challenges. Architectural models, Fundamental Models.

**Theoretical Foundation for Distributed System:** Limitation of Distributed system, absence of global clock, shared memory, Logical clocks, Lamport's & vectors logical clocks.

**Concepts in Message Passing Systems:** Causal order, total order, total causal order, Techniques for Message Ordering, Causal ordering of messages, global state, termination detection.

**Distributed Mutual Exclusion:** Classification of distributed mutual exclusion, requirement of mutual exclusion theorem, Token based and non token based algorithms, performance metric for distributed mutual exclusion algorithms.

**Distributed Deadlock Detection:** System model, resource Vs communication deadlocks, deadlock prevention, avoidance, detection & resolution, centralized dead lock detection, distributed dead lock detection, path pushing algorithms, edge chasing algorithms.

**Agreement Protocols:** Introduction, System models, classification of Agreement Problem, Byzantine agreement problem, Consensus problem, Interactive consistency Problem, Solution to Byzantine Agreement problem, Application of Agreement problem, Atomic Commit in Distributed Database system.

**Distributed Resource Management:** Issues in distributed File Systems, Mechanism for building distributed file systems, Design issues in Distributed Shared Memory, Algorithm for Implementation of Distributed Shared Memory.

**Failure Recovery in Distributed Systems:** Concepts in Backward and Forward recovery, Recovery in Concurrent systems, Obtaining consistent Checkpoints, Recovery in Distributed Database Systems.

**Fault Tolerance:** Issues in Fault Tolerance, Commit Protocols, Voting protocols, Dynamic voting protocols.

**Transactions and Concurrency Control:** Transactions, Nested transactions, Locks, Optimistic Concurrency control, Timestamp ordering, Comparison of methods for concurrency control.

**Distributed Transactions:** Flat and nested distributed transactions, Atomic Commit protocols, Concurrency control in distributed transactions, Distributed deadlocks, Transaction recovery.

**Replication:** System model and group communication, Fault - tolerant services, highly available services, Transactions with replicated data.

### **Reference Books:**

1. Singhal & Shivaratri, Advanced Concept in Operating Systems, TMH
2. Coulouris, Dollimore, Kindberg, Distributed System: Concepts and Design, Pearson Education.
3. Tenanuanbauma and Steen, Distributed Systems, PHI.

### **MCA417 SOFTWARE PROJECT MANAGEMENT**

**Overview of Project Management:** PMI Processes, Software project phases, Organizational structures, Project charter, Statement of Work (SOW)

**Planning Phase :** Development lifecycle models, Matching lifecycles to projects, Project plans, Work Breakdown Structures (WBS)

**Estimation and Budgeting:** Estimation, Budgeting, Project selection, NPV, ROI, Payback models

**Scheduling :** Project network diagram fundamentals, PERT techniques and Gantt charts

**Risk and Change Management:** Risk management, Change control, Development Management, Team models, Requirements process, Configuration management, Software metrics, Programming languages & tools, managing conflict and motivating

**Project Control:** Status reporting, Project metrics, Earned value analysis, Communications Techniques

**Final Phases & Other Issues:** Project Recovery, Documentation, Cutover/Migration, Post Project Reviews, Closing

**Project Success:** Management support, Expectations, Success metrics

#### **Reference Books:**

1. McConnell, Steve , Rapid Development, Microsoft Press.
2. Schwalbe and Kathy, Information Technology Project Management, Cengage Learning..
3. Kerzner, Harold, Project Management: A Systems Approach to Planning, Scheduling, and Controlling , JohnWiley
4. Walker Royce, Software Project Management, Pearson Education
5. Bob Hughes and Mike Cotterell, Software Project Management, TMH
6. Joel Henry, Software Project Management, Pearson Education
7. Pankaj Jalote, Software Project Management in practice, Pearson Education

### **MCA418 HUMAN COMPUTER INTERFACE**

**Introduction to HCI:** A Brief History of HCI (A Survey of HCI Technology), User Interface Design and its importance, Principles on User Interface Design Models, Principles, Practices Interaction Design with Direct Manipulation Overview, Scope, Applications

**Cognitive Framework of HCI:** Definition of HCI, Cognitive perspective in HCI, Human information processing, Role of cognition in HCI design , Visual Perception & Representation , Different mode of

perceptions , Theories of vision, Marr’s theory, Constructivist approach, Ecologist approach, How theories of vision can influence interface design, Graphical modeling, Graphical coding

**Attention and Interface Design-:** Memory in Interface Design-Multi-store model of Memory, Memory in HCI design Knowledge , Knowledge representation, Utility of knowledge representation in HCI, Mental models, Utility of mental models in HCI User Modeling , Interaction with Natural Languages, Next Generation Interface, UI Evaluation: Introduction, Cognitive models (KLM, GOMS, Fitt’s Law, Applications of Cognitive Model in HCI),

**Introduction to HCI evaluation:** Role and goals of Evaluation, Evaluation techniques(Heuristic Evaluation, Evaluation with Cognitive Models, Evaluation with Users, Model-based Evaluation through User Participation (Empirical or experimental methods, Observational method, Query techniques, Physiological monitoring techniques)

### **Reference Books**

1. Ben Shneiderman, User Interface Design: Strategies for Effective Human Computer Interaction, Addison Wesley.
2. Alan Dix, Janet Finlay, Gregory Abowd, Russel Beale, Human Computer Interaction, PHI.
3. Jenny Preece, Yvaonne Rogers, Helen Sharp, David Benyan, Simon Holand, Tom Carey , Human Computer Interaction, Addison Wesley.

## **PRACTICAL**

### **MCA 491 ENTERPRISE COMPUTING LAB**

Remote Method Invocation (Overview, Architecture), Example Demonstrating RMI. Servlets (Servlet Life Cycles, Scopes, Filters & Listeners, Session Tracking & Management, Servlet Chaining), Java Server Pages (Implicit Objects, Tags & Expressions, Scripting, Custom Tag ), JDBC (javax.sql, Types of Drivers, Connection Pool, Calling Database Stored Procedures), Session beans - Entity beans - Programming and deploying enterprise Java Beans (Life Cycles, Deployment Descriptors). JAVA API for XML (DOM, SAX), Web-Services Using AXIS, Creational-Design Patterns, Structural Patterns, Behavioral Patterns Examples, Sample Applications Using Struts, Spring, Hibernate.

### **MCA 492 COMPUTER GRAPHICS & ANIMATION LAB**

Study of basic graphics function defined in graphics header files. Basic animation using inbuilt functions, Line drawing using DDA algorithm, Bresenham’s line drawing algorithm. Circle drawing using midpoint’s circle algorithm, ellipse drawing using mid-point ellipse drawing algorithm. Implement 2D Transformations- Translation, Scaling, Rotation on a shape. Perform 2D reflection, shearing on a square. Perform Cohen Sutherland line clipping & windowing. Implement polygon clipping.

### **MCA 493 PROFESSIONAL COMMUNICATION LAB**

#### **GD**

1. GD Basics: Structure, Motive, Modes, Seating, Formats
2. GD Roles: Leader, Coordinator, Questioner, Facilitator, Abstainer & Blocker
2. GD Strategies: Introduction, Discussion & Summarisation

## **Résumé**

1. Résumé Basics: Sections, Formatting, Ordering, Drafts & Exclusions
2. Types: Functional, Chronological and Hybrid
3. Job letter / Cover letter: Paper form, e-mail and attachments

## **Interview**

1. Interview Types: Fresher, Promotion, Appraisal, Stress, Academic, Exit & Group
2. Interview Strategies: Handling Stress, Trick, Ethical, Weakness & Monetary questions
2. Interview Preparation: Practice with groups, mirror, multimedia and peers with feedback

## **Reference Books:**

1. Bovee et al, Business Communication Today, Pearson Education.

## **SEMESTER-5**

### **MCA 501 ARTIFICIAL INTELLIGENCE**

**Introduction to Artificial Intelligence:** The Foundations of Artificial Intelligence, The History of Artificial Intelligence and The state of the Art.

**Intelligent Agents:** Introduction, How Agents should act, Types of agents , Structure of Intelligent Agents Environments.

**Solving Problems by searching:** Problem-solving Agents, Formulating Problems, Example Problems, and Searching for solutions, Search Strategies, Avoiding Repeated States, and Constraint Satisfaction Search.

**Informed search Methods:** Best-First Search, Heuristic Functions, Memory Bounded search, and Iterative Improvement Algorithms.

**Agents that Reason Logically:** A Knowledge-based Agent, The Wumpus world Environment, Representation, Reasoning & and Logic, Propositional Logic: A Very simple logic, an agent for The Wumpus World.

**First-Order Logic:** Syntax and Semantics, Extensions and Variations, Using First Order logic, Logical agents for The Wumpus World.

**Conference In First-Order logic:** Inference Rules Involving Quantifiers, An Example Proof Generalized Modus Ponens, Forward and Backward Chaining & Completeness. Resolution: A complete Inference Procedure, Completeness of Resolution.

**Planning:** A simple planning agent form problem solving to planning, planning in situation calculus. Basic representations for planning. A partial-order planning example, A partial order planning algorithm.

**Making simple Decisions:** Combining beliefs and desires Under Uncertainty, The Basis of Utility theory, Utility Functions, Decision Networks and The Value of Information.

**Neural network:-** Learning in Neural and Belief Networks, How the Brain Works, Neural Network Perceptions. Multilayered feed forward Networks , Back Propagation algorithm, Applications of Neural Networks.

**Agents that communicate:** Communication as an action, steps of communication, A formal grammar for a subset of English, syntactic analysis (Parsing), Definite Clause Grammar (DCG), Augmenting a Grammar, Semantic Interpretation, Ambiguity and Disambiguation, A communicating Agent.

**Practical Natural Language Processing:** Practical applications, Efficient parsing, Scaling up the lexicon, scaling up the grammar ambiguity, Discourse, Understanding.

**Reference Books:**

1. Russell S. J & Norvig P, Artificial Intelligence: A modern Approach, Pearson Education.
2. Winston P.H, Artificial Intelligence, Addison Wesley.
3. Rich E & Knight K, Artificial Intelligence, TMH.
4. Nilsson, Artificial Intelligence, Elsevier.

**MCA502 CRYPTOGRAPHY AND NETWORK SECURITY**

**Introduction:** Security Goals, Attacks, Services and Mechanisms, Symmetric-Key, Asymmetric-key, A Model for Internetwork Security, Steganography.

**Classical Encryption Techniques:** Substitution ciphers, Transposition ciphers, Stream and block ciphers, cryptanalysis.

**Modern Symmetric-key Encryption:** Modern Techniques: Simplified DES, Block Cipher Principles, The Data Encryption Standard(DES), Strength Of DES, Differential And Linear Cryptanalysis, Block Cipher Design Principles, AES.

**Modern Encryption Algorithms:** Multiple DES, Block Cipher Modes of Operation, International Data Encryption Algorithms, Blowfish, RC5, A5/1, CAST, Characteristics Of Advanced Symmetric Block Ciphers.

**Public-Key Cryptography:** Principles of Public-Key Cryptosystems, The RSA Algorithm, Elgamal Cryptosystem, Elliptic Curve Cryptography.

**Message Integrity & Authentication:** Message Integrity, Authentication Functions, Message Authentication Codes (MAC), Hash Functions, Security Of Hash Functions And Macs. Hash And MAC Algorithms (MD5 Message Digest Algorithm, Secure Hash Algorithm (SHA-1), SHA-512), HMAC.

**Digital Signatures and Authentication Protocols:** Digital Signatures, Authentication Protocols, Digital Signature Standard (DSS), Entity Authentication.

**Key Management:** Key Distribution, KDC, Session keys, KERBEROS, Diffie-Hellman Key Exchange, X.509 Authentication Service, PKI.

**Network Security:** Security at Application layer: E-mail Security, PGP, S/MIME. Security at Transport layer: Secure Sockets Layer(SSL) and Transport Layer Security(TLS), Secure Electronic Transaction. Security at Network layer: IPsec. Secure Electronic Transaction,

**System Security:** Intruders, Intrusion Detection Systems (IDS), Malicious Software, Firewalls: Firewall Design Principles, Trusted Systems

**Reference Books:**

1. Behrouz A. Forouzan, Cryptography & Network Security, TMH.
2. William Stallings, Cryptography & Network Security, Pearson Education.
3. Alfred J. Menezes, Hand Book of Applied Cryptography, MIT Press
4. John Hershey, Cryptography Demystified Part I, TMH.
5. B. Schmeien, Applied Cryptography, John Wiley.

**MCA 503 MANAGEMENT SUPPORT SYSTEMS**

**An Overview:** Managerial decision-making & Information systems, Managers and computerised supports, the need for computerised support. A framework for decision supports the concept of decision support system. Group system, EIS expert systems & intelligent agents, knowledge management system.

**Decision making system, Multiple & Support:** System , Models, A preview of the modeling process. The intelligent phase. The design phase, The choice Phase, Multi goals, Sensitivity analysis, What-if and goal seeking. The implementation phase. How decisions are supported, Alternative decision making models.

**DSS: An Overview:** DSS configurations, characteristics and capabilities of DSS, components of DSS, The data management subsystems the model management subsystems, the user DSS classifications, DSS Vs MIS. Data, Warehousing, Analysis,

**Mining & Visualisation:** Data warehousing, Analysis & visualisation, Sources of data. Data collection problems & quality, DBMS in DSS, Data warehousing, Data mining Data visualisation and multidimensionality, Geographic Information systems.

**Modelling & Analysis:** Modelling for MSS, Static & dynamic models, Treating certainty, uncertainty & risk, Influence diagrams, Heuristic programming Simulation, Multidimensional modeling, Visual interactive modeling & simulation, Quantitative software packages-OLAP.

**DSS Development:** Introduction to DSS Development, The traditional SDLC, alternate development methodologies, Prototyping, DSS technology and tools, Development Platforms, Development tool selection, Team development DSS, End user developed ,DSS, Putting the system together Research directions and future of DSS.

**Group Support Systems (GSS):** Group decision making , Communication and Collaboration, Communication Support, Collaboration support, Group support systems, its technologies, group systems, The GSS meeting process.

**Enterprise Decision support systems:** Enterprise systems: Concepts & Definitions and its evolution, Characteristics of EIS, Comparing and integrating EIS & DSS. Organizational DSS, supply & value chains and Decision support, Supply chain problems & solutions,

**Computerized systems:** MRP, ERP & SCM. Introduction to knowledge management: knowledge, Organizational learning & Organizational memory, Knowledge management.



**Implementing & Integrating Management Support Systems:** Implementation An overview, major issues, strategies, generic models, Models of ES & DSS integration, integrating EIS, DSS & ES and global integration, intelligent DSS, Intelligent modeling & model management, Examples.

**Impact of MSS:** Introduction, Overview, Organizational structure & related areas, MSS support to business process reengineering, personal management issues, Impact on individuals, Impact on productivity, Quality & competitiveness, issues of legality, privacy & Ethics.

**Reference Books:**

1. E.Turban & J.E.Aronson, Decision support system & Intelligent System, Pearson Education.
2. R.H. Sprague & E.D Carlson, Building Effective DSS, PHI.
3. Loffi, Decision Support Systems operations and Management, TMH.
4. Mallach, Decision support and Data Warehouse Systems, TMH.

**Elective – II**

**MCA511 PARALLEL AND DISTRIBUTED ALGORITHMS**

Motivations for parallel processing, Abstract Models of parallel and distributed computation, Taxonomy, PRAM, BSP, Multithreading, Distributed Shared Memory, complexity measures: The PRAM Model: balancing, divide and conquer, parallel prefix computation, pointer jumping, symmetry breaking, list ranking, backtracking, branch-and-bound, divide and conquer, sorting and searching, graph algorithms, parallel complexity and complexity classes, lower bound.

**Parallel Programming Overview** – Processes, Tasks and Threads – Parallelism Issues – Interaction / Communication Issues – Semantic Issues In Parallel Programs.

Interconnection Networks: Static and Dynamic , topologies (arrays and mesh networks, trees, systolic networks, hypercubes, butterfly) and fundamental algorithms, matrix algorithms, sorting, graph algorithms, routing, relationship with PRAM models; Asynchronous Parallel Computation.

Distributed Algorithms: models and complexity measures, safety, liveness, termination, logical time and event ordering, global state and snapshot algorithms, mutual exclusion, clock synchronization, election, termination detection, routing, Distributed graph algorithms.

Matrix Computations: Dense and Sparse, Combinatorial Optimization: Dynamic Programming, Branch and Bound, A\*, N-Body problems.

Applications: Sorting and Searching: algorithms for different models and their comparison,

**Reference Books:**

1. V. Rajaraman , C. Murthy, Parallel Computers: Architecture and Programming, PHI.
2. Vipin Kumar, Ananth Grama, Anshul Gupta and G. Karypis, Introduction to Parallel Computing, Addison Wesley.
3. SashiKumar, Shikhare, Introduction to Parallel Processing, PHI.

4. Lynch, Distributed Algorithms, Elsevier.

### **MCA512 THEORY OF COMPUTATION**

**Models of Computation:** Machine models (Turing Machines, Non-determinism, Post machines, Two Counter Machines), Logic (Proposition and Predicate Logic), Grammars and Languages, lambda Calculus, Term Rewriting.

**Undecidability:** Undecidable Problems, Reductions, Rice's Theorem, Recursively Enumerable and Recursive Languages, Oracle Machines and the Arithmetic Hierarchy, Axioms for Number Theory, Computation as a Number Theoretic concept, Undecidable and Incompleteness.

**Computable functions:** Primitive Recursive and mu-recursive functions, non-numeric functions.

**Computational Complexity:** Tractability, P, NP, Polynomial Hierarchy, Completeness, Randomized Computation, Probabilistic Computation, Quantum Computation.

#### **Reference Books:**

1. John E. Hopcroft, Rajeev Motwani Jeffrey D. Ullman, Introduction to Automata and Language Theory, Narosa.
2. J C Martin, Introduction to Languages & Theory of Computation, Pearson Education.
3. DLP Mishra & N Chandra Sekharan, Theory of Computer Science, PHI

### **MCA513 DISTRIBUTED DATABASE MANAGEMENT**

**Introduction:** Distributed Data Processing, Distributed Database system (DDBS), Advantages & Disadvantages of DDBS, Problem areas, Overviews of relational DBMS (RDB concepts, Normalization, Integrity rules, relational Data languages) DBMS Architecture (DBMS standardization, Architecture middlewares for DDBMS)

**Distributed Database Design:** (alternative design strategies, distribution design issues, fragmentation, allocation) Semantic Data Control (View Management, Data Security, Semantic integrity control)

**Query Processing:** (Object of Query Processing, Complexity of relational algebra operations, Characterization of query processors, layers of query processing) Query decomposition), Query Decomposition and localization of Distributed Data, Optimization of distributed queries (Query optimization, Centralized query optimization, join ordering in fragment queries, Distributed query optimization algorithms)

**Transaction Management:** (Definition properties and types of transaction, architecture), Distributed Concurrency control (serializability, Taxonomy of concurrency control mechanisms, locking and algorithms, Optimistic concurrency control algorithms)

**Distributed DBMS Reliability:** (Reliability concepts and measures, Failure and fault tolerance in distributed reliability protocols)

Parallel Database Systems (Database servers, Parallel architectures, parallel DBMS techniques, parallel execution problems, Parallel execution for hierarchical architecture)

**Distributed object Database Management System:** (Fundamentals of object concepts and modules, Object distribution design, Architectural issue, Object management Distributed object storage, Transaction Management).

### **Reference Books:**

1. Ceri, Distributed Database Management, TMH.
2. M. Tamer Ozsu, P Valduriez- Principle of Distributed Database Systems, Pearson Education.
3. Korth, Silberchatz, Sudarsan, Database System and Concept, TMH.

## **MCA514 Performance Evaluation and Reliability of Information Systems**

**Review of probability and statistics:** Introduction, random variables, probability distributions, densities, jointly distributed random variables, expectation.

**Stochastic processes:** Introduction, basic definitions, Poisson process, birth-death process, Markov process.

**Queueing Theory:** Queueing systems, networks of queues, Queueing network models , computational methods for queueing network solutions.

**Parameter estimation and hypothesis testing:** Models of information systems, Introduction to reliability measures.

**Selection of Techniques and Metrics:** Selecting an evaluation technique, selecting performance metrics, commonly used performance metrics, utility classification of performance metrics, setting performance requirements.

**Performance measures:** Estimation of MTF and other reliability parameters, Software metrics and software reliability models, Workload design, Benchmarks, case studies.

### **Reference Books:**

1. Fortier & Michel, Computer Systems Performance Evaluation and Predictions, Elsevier.
2. Jain, The Art of Computer System Performance Analysis, John Wiley.

## **MCA515 SOFTWARE CONFIGURATION MANAGEMENT**

**Overview of Software Configuration Management:** Introduction, Common Myths, Importance of SCM, benefits of SCM

**Software Development Process:** Software Lifecycle, SDLC phases, Communications breakdown problem, Shared Data Problems, Multiple Maintenance problem, Simultaneous update problem

**SCM Basic Concepts:** Introduction, Overview, Baselines, Check in, Check out, Parallel Development and branching, Version naming, Source and Derived Items, System Building and Releases

**Phases of SCM implementation:** Introduction, Objectives, SSM implementation phases, SCM tool retirement, Reasons for SCM failure

**Configuration Identification:** Impact of configuration item selection, Baselines, Configuration item selection, Designation, Configuration item description,

**Configuration Control:** Change, Deviations and Waivers, Problems of Uncontrolled Change, Configuration Control phases, File based versus change based change management, Escalation, Notification and fixes, Problem – reporting, tracking, change request and identification. Defect – Classification, severity, prevention

**Status Accounting:** Status accounting and information gathering, Status accounting reports, Status accounting and automation

**Configuration verification and audits:** Software reviews, Configuration verification, Functional Configuration Audits, Physical Configuration Audits, Role of SCM team in Configuration Audits

#### **Reference Books:**

1. Alexis Leon, Rapid Software Configuration Management Handbook, Artech House
2. H. Ronald Berlack, Software Configuration Management , John Wiley.

### **MCA 516 REAL TIME SYSTEMS**

**Introduction:** What is real time, Applications of Real-Time systems, A basic model of Real-time system, Characteristics of Real-time system, Safety and Reliability, Types of Real-time tasks, timing constraints, Modelling timing constraints

**Real-Time Task Scheduling:** Some important concepts, Types of Real-time tasks and their characteristics, Task scheduling, Clock-Driven scheduling, Hybrid schedulers, Event-Driven scheduling, Earliest Deadline First (EDF) scheduling, Rate monotonic algorithm (RMA). Some issues Associated with RMA. Issues in using RMA practical situations.

**Handling Resource Sharing and dependencies among Real-time Tasks:** Resource sharing among real-time tasks. Priority inversion. Priority Inheritance Protocol (PIP), Highest Locker Protocol (HLP). Priority Ceiling Protocol (PCP). Different types of priority inversions under PCP. Important features of PCP. Some issues in using a resource sharing protocol. Handling task dependencies. Scheduling Real-time tasks in multiprocessor and distributed systems: Multiprocessor task allocation, Dynamic allocation of tasks. Fault tolerant scheduling of tasks. Clock in distributed Real-time systems, Centralized clock synchronization

**Commercial Real-time operating systems:** Time services, Features of a Real-time operating system, Unix as a Real-time operating system, Unix-based Real-time operating systems, Windows as a Real-time operating system, POSIX, A survey of contemporary Real-time operating systems. Benchmarking real-time systems.

**Real-time Databases:** Example applications of Real-time databases. Review of basic database concepts, Real-time databases, Characteristics of temporal data. Concurrency control in real-time databases. Commercial real-time databases.

**Real-time Communication:** Examples of applications requiring real-time communication, Basic concepts, Real-time communication in a LAN. Soft Real-time communication in a LAN. Hard real-time communication in a LAN. Bounded access protocols for LANs. Performance comparison, Real-time communication over packet switched networks. Qos framework, Routing, Resource reservation, Rate control, Qos models.

**Reference Books:**

1. Rajib Mall, Real-time Systems Theory and Practice, Pearson Education.
2. Jane W. S. Liu, Real-time Systems , Pearson Education.
3. K.V.K.K. Prasad, Embedded Real Time Systems:Concepts,Design Programming, Wiley.

**MCA 517 EMBEDDED SYSTEMS**

**Introduction:** An embedded system, Processor in the system, other hardware units, software embedded into a systems, exemplary embedded system-on-chip (SOC) and VLSI circuit

**Devices and Device Drivers ;** I/O devices, Timer and counting devices, serial communication using the IC, CAN and advance I/O buses between the networked multiple devices, Host system or computer parallel communication between the networked I/O multiple devices using the ISA, PCI, PCI-X and advance buses, Device drivers, Parallel port devices drivers in a system, Serial port device drives in a system, Interrupt servicing (Handling) mechanism.

**Software and Programming Concept :** Processor selection for an embedded system, memory selection for an embedded system, Embedded programming in C ++, Multiple processes and application, problem of sharing data by multiple tasks and routines, Inter process Communication.

**Hardware and Software Co-design:** Embedded system project management, Embedded system design and co-design issues in system development process, design cycle in the development phase for an embedded system, Use of software tools for development of an embedded system, Issues in embedded system design.

**Reference Books:**

1. Raj Kamal, Embedded System Architecture, Programming and Design, TMH.
2. Ralf Niemann, Hardware/software co-design for data flow dominated embedded systems, Kulwer Academic Publisher.
3. Sriram V. Iyer and Pankaj Gupta, Embedded Real time system Programming, TMH

**ELECTIVE-III**

**MCA522 SOFT COMPUTING**

**Fuzzy logic:** Fuzzy set theory: crisp sets, fuzzy sets, crisp relations, fuzzy relations, Fuzzy Systems: Crisp logic predicate logic, fuzzy logic, fuzzy Rule based system, Defuzzification Methods.

**Neural Networks:** Fundamentals of Neural Networks: Models of an artificial Neuron, Neural Network Architecture, Learning methods

**Genetic algorithms:** Fundamentals of genetic algorithms: Encoding, Fitness functions, Reproduction. Genetic Modeling: Cross cover, Inversion and deletion, Mutation operator, Bit-wise operators, Bitwise operators used in GA. Convergence of Genetic algorithm. Applications , Real life Problems.

**Back Propagation Networks:** Architecture of a Back propagation Network: back propagation, Learning Effect of Tuning parameters of the Back propagation Neural Network, variation of standard Back Propagation Algorithms.

**Associative memory :** Auto correlators, Kosko's Discrete BAM, Exponential BAM, Associative memory for Real-coded Pattern Pairs, Applications. Adaptive Resonance Theory : ART1,ART2, Applications

**Hybrid Systems:** Hybrid system, neural Networks, fuzzy logic and Genetic algorithms hybrids. Genetic Algorithm based Back propagation Networks: GA based weight determination applications: Fuzzy Back Propagation Networks, Fuzzy Associative Memories: Single Association FAM, Fuzzy Hells FAMS, Fuzzy logic controlled genetic Algorithms soft computing tools, Fuzzy constraints, GA in fuzzy logic controller design, Applications.

### **Reference Book**

1. S.Rajasekaran, G.A. Vijayalakshmi Pai , Neural Networks, Fuzzy Logic, and Genetic Algorithm ( synthesis and Application) , PHI
2. J. S. R. JANG, C.T. Sun, E. Mizutani, Neuro Fuzzy and Soft Computing, PHI

## **MCA523 ADVANCED DATABASE**

**Relational Database Design Algorithms and Dependencies:** Algorithms for Relational Database Schema Design, Multivalued, Join, Inclusion and other dependencies.

**Algorithms for Query processing and Optimization:** Translating SQL queries into RA. Algorithms for SELECT, PROJECT, JOIN and SET operations. Using Heuristics in Query Optimization, Cost estimations in Query Optimization.

**Concurrency Control and Recovery Technique:** Two-Phase Locking, Timestamp ordering, Multi-version Concurrency Control Technique, Optimistic Concurrency Control Technique, Granularity of data items. Other Concurrency Control Techniques, Recovery concepts, Deferred update, Immediate update, Shadow paging, The ARIES Recovery Algorithm, Recovery in multi-database system, Recovery from Catastrophic failures.

**Database Security:** Database Security Issues, Discretionary Access Control, Mandatory Access Control, Role-based Access control, Statistical Database Security, Encryption, Privacy and Challenges of Database Security.

### **Object Oriented and Object Relational Databases:**

Concepts for Object Databases : Object Identity, Object Structure, Type Constructors, Encapsulation of Operations, Methods, Persistence, Type and Class Hierarchies, Inheritance, Complex Objects. Object Relational and Extended Databases: Relational Systems, Object Relational Features in SQL/Oracle.ODMG Model: ODL, Object Query Language (OQL).

**Mobile Databases:** Location and Handoff Management, Effect of Mobility on Data Management, Concurrency Control, Transaction Commit Protocols, Mobile Database, Recovery Schemes.

**Multimedia Databases:** Multimedia Data Structures and formats, Multimedia Database Design, Retrieval Techniques.

### **Reference Books:**

1. Raghu Ramakrishnan and Johannes Gehrke, Database Management Systems, TMH.
2. C. J. Date, Introduction To Database Systems, Addison Wesley.
3. Elmasri, Navathe, Database System Concepts, Pearson Education.
4. Silbersetatz, Korth, Sudarshan , Database system concepts. TMH.
5. Bipin. C. Desai, Database Management., Galgotia Publication.
6. Leon and Leon, Database Management System, Vikash Publication

## **MCA524 VISUAL COMPUTING**

**Introduction to VB.NET:** Event Driven Programming, .NET as better Programming Platform, .NET Framework, .NET Architecture, The Just-In-Time Compiler, .NET Framework class library introduction.

**VB.NET Development Environment:** Creating Applications, Building Projects, Using simple components, Running VB.NET applications.

**Mastering VB Language:** Data, Operators, Conditionals and Loops, Procedures, Error Handling, Classes and Objects.

**Windows Applications in VB.NET:** Windows Forms, Text Boxes, Buttons, Labels, Check Boxes, and Radio Buttons, List Boxes, Combo Boxes. Picture Boxes, Scrollbars, Splitters, Timer, Menus, Built-in Dialogs, Image List, Tree Views, List Views, Toolbars, Status Bar and Progress bars.

**Object Oriented Programming in VB.NET:** Class and Object, Properties, methods and events, Constructors and Destructors, Method overloading, Inheritance, Access modifiers : Public, Private, Protected, Friend, Overloading and Overriding, Interfaces, Polymorphism.

**Databases Connectivity with ADO.Net:** The ADO .NET Object Model, Database : Connections, DataAdapters, and DataSets, DataReader, Connection to database with server explorer, Multiple Table Connection, Finding and Sorting Data in DataSets, Using XML Data

**Web Services:** SOAP, WSDL, Disco and UDDI, Instantiating - Invoking Web Services, Creating Proxy Classes with WSDL, Creating Web Service Project.

### **Reference Books:**

1. Francesco Balena, Programming Microsoft Visual Basic.NET, MicroSoft Press, PHI
2. Jeffrey R. Shapiro, The Complete Reference -Visual Basic .NET, TMH
3. Murach's VB.NET database programming with ADO.NET -Anne Prince and Doug Lowe
4. Jeff Salvage, The Visual Basic.NET COACH, Addison Wesley
5. Steven Holzner, Visual Basic .NET 2003 in 21 Days. –SAMS Publications.

### **MCA525 MULTIMEDIA & ANIMATIONS**

**Introduction to Animation :** History , Uses, Types and Principles of Animation, Some Techniques of Animation , Animation on the WEB, 3D Animation, Special Effects, Creating Animation.

**Creating Animation in Flash:** Introduction to Flash Animation , Introduction to Flash , Working with the Timeline and Frame-based Animation, Working with the Timeline and Tween based Animation, Understanding Layers - Actionscript.

**3D Animation & its Concepts:** Types of 3D Animation, Skeleton & Kinetic 3D Animation, Texturing & Lighting of 3D Animation, 3D Camera Tracking, Applications & Software of 3D Animation.

**Motion Caption:** Formats, Methods, Usages, Expression, Motion Capture Software's, Script Animation Usage, Different Language of Script Animation Among the Software.

**Concept Development :** Story Developing, Audio & Video, Color Model, Device Independent Color Model, Gamma and Gamma Correction, Production Budgets, 3D Animated Movies.

### **Reference books:**

1. Ranjan Parekh, Principles of Multimedia, TMH.
2. Ashok Banerji, Ananda Mohan Ghosh, Multimedia Technologies, TMH.
3. John F. Koegel Buford, Multimedia Systems, Pearson Education.
4. Ralf Steinmetz & Klara Nahrstedt, Multimedia: Computing Communications & Applications, Pearson Education.

### **MCA526 ENTERPRISE RESOURCE PLANNING**

**Introduction to Enterprise Resource Planning (ERP):** Fundamentals of enterprise resource planning (ERP) systems concepts, and the importance of integrated information systems in an organization, illustrating procurement, production, and sales business processes using ERP software.

**Use of Business Intelligence:** Application of "intelligent" techniques from CS (AI, data mining), and OR (stochastic modeling, simulation, forecasting) to business decision-making. Use of any tool to access and present data, search for patterns, identify exceptions, forecast, optimize, and schedule resources.



**ERP System Design, Configuration, Integration and Implementation:** Technological infrastructure, and integration of business enterprise-wide applications. Design and implementation practices for business processes in ERP systems.

**ERP System Administration & PORTALS:** System administration and performance monitoring practices for an ERP. User management attributes and system security. Introduction to Enterprise Portals.

**Overview of different Functional Modules of ERP:** Supply Chain Management (SCM), Customer Relation Management (CRM), HR, FINANCE, Sales & Distribution, Material Management etc.

**About Different ERP-Packages:** Introduction to SAP, ORACLE-APPS, People Soft, Siebel, etc.

### **Reference Books:**

1. Ashim Raj Singla, Enterprise Resource Planning, Cengage Learning.
2. Ellen F Monk, Bret J Wagner, Enterprise Resource Planning, Cengage Learning
3. Vinod Kumar Garg, N.K. Venkitakrishnan, Enterprise Resource Planning, PHI.
4. N. Venkateswaran, ERP (Enterprise Resource Planning), Scitech.

## **MCA 527 SIMULATION AND MODELLING**

**System models:** Role of simulation. Entities, Attributes, States and Activities.

**Types of systems:** Deterministic, Stochastic, Continuous and Discrete systems. Steps in simulation studies.

**Statistical tools and techniques:** Generation of pseudo random numbers, random variate generation for uniform, Poisson and normal distributions.

**Sampling:** Estimation, maximum likelihood estimation, confidence intervals and hypothesis testing, stochastic processes and Markov models. Discrete event simulation languages.

**Simulation of inventory and Queuing systems:** single and multiserver queues, network of queues.

**Modelling and performance evaluation of computers:** Computer communication networks. Workload characterization. Continuous system simulation languages, growth and decay models,

**Verification and validation of simulation models** - input/output validation, performance measures and their estimation. Case studies.

### **Reference Books:**

1. A. M. Law and W. D Kelton, Simulation Modeling and Analysis, TMH.
2. J. Banks, S. Carson, B. L. Nelson, "Discrete Event System Simulation, Pearson Education.
3. Ross, Simulation, Elsevier.
4. N. Deo, System Simulation with digital computers, PHI
5. Gordon, System Simulation, PHI.

## PRACTICAL

### MCA591 AI LAB

The laboratory should use languages such as PROLOG or LISP to solve the laboratory exercises.

Topics may include data types, conditionals , lexical variables, recursion, I/O structures etc.

It is also suggested that an expert system shell such as IITM rule may be used to create a small expert for, say, trouble shooting merged VCR etc. Some suggested experiments are tour of India, Stable marriage problem, game planning (such as bridge), coin change problem etc.

### MCA592 SOFT COMPUTING LAB

#### **Artificial intelligence (Algorithms)**

P1: Simulate dfs.

P2: Simulate bfs.

P3: Simulate a\*.

P4: Simulate ao\*.

P5: Simulate 8-puzzle problem.

#### **Artificial neural network**

P1: Implement and function using adapline with bipolar inputs and outputs.

P2: Implement and function using medaline with bipolar inputs and outputs.

P3: Matlab program to implement discrete hopfield network and test for input pattern.

P4: Matlab program to implement full computer propagation network for a given input pattern.

P5: Matlab program to implement back propagation network for a given input pattern.

P6: Implement art 1 network for clustering input vectors with vigilance parameter.

#### **Fuzzy logic**

P1: Matlab program to implement fuzzy set operation and properties.

P2: Program to implement composition of fuzzy and crisp relations.

P3: Perform max-min composition of two matrices obtained from cartesian product.

P4: Verify the various laws associated with fuzzy set.

#### **Genetic algorithm**

P1: Matlab program for maximizing  $f(x)=x^2$  using GA, where x is ranges from 0 to 31. Perform only 5 iteration.

P2: Implementation in few application areas.

### MCA593 PL/SQL LAB

**Basics of PL/SQL:** PL/SQL architecture, PL/SQL and SQL\*Plus, PL/SQL Basics, Variables, Constants, Datatypes.

**PL/SQL structures:** Simple blocks, Control structures, PL/SQL records, Recognizing the Basic PL/SQL Block and Its Sections, Describing the Significance of Variables in PL/SQL , Distinguishing Between PL/SQL and Non-PL/SQL Variables , Declaring Variables and Constants , Executing a PL/SQL Block.

**Error checking – exception handling:** Defining exceptions, Using the when others clause, Ensuring complete error checking, Passing error messages to calling routine.

**Boolean logic in PL/SQL:** Identifying the Uses and Types of Control Structures, Constructing an IF Statement, Constructing and Identifying Different Loop Statements, Controlling Block Flow Using Nested Loops and Labels, Using Logic Tables, If-then-else structure, Testing for numbers characters and Booleans.

**Cursors in PL/SQL:** Cursor basics, Using a cursor for a multi-row SQL query.

**Iteration in PL/SQL:** For loop , While loop.

**Triggers in PL/SQL:** Triggers and database events, Defining a trigger , Timing a trigger , Enabling and disabling a trigger.

**Stored procedures, functions and packages:** Basics of stored procedures, Basics of functions, Basics of packages, Defining stored procedures & functions, Function and stored procedures prototypes, Passing arguments to functions and stored procedures, Recompiling functions and stored procedures.

### **MCA594 VISUAL COMPUTING LAB**

**VB.NET Development Environment :** User Interface Design, Creating Applications, Building Projects, Using simple components, Running VB.NET applications.

**Mastering VB Language :** Data Types, Operators, Conditionals and Loops, Procedures.

**Windows Applications in VB .NET Using Controls and Components :**Windows Forms, Text Boxes, Buttons, Labels, Check Boxes, and Radio Buttons, List Boxes, Combo Boxes. Picture Boxes, Scrollbars, Splitters, Timer, Menus, Built-in Dialogs, Image List, Tree Views, List Views, Toolbars, Status Bar and Progress bars.

**Object Oriented Programming in VB .NET :** Class and Object, Properties, methods and events, Constructors and Destructors, Method overloading, Inheritance, Access modifiers : Public, Private, Protected, Friend, Overloading and Overriding, Interfaces, Polymorphism.

**Handling and Throwing Exceptions :** Debugging an Application, Creating Throwing and Handling Exceptions.

**Data Access Using ADO:** The ADO .NET Object Model, Database : Connections objects, DataAdapters objects, and DataSets object, DataReader objects, Connection to database with server explorer, Multiple Table Connection, Finding and Sorting Data in DataSets, Using XML Data with XmlReader object

**Web Services :** UDDI, Instantiating - Invoking Web Services, Creating Proxy Classes.

#### **References Book:**

1. Francesco Balena, Programming Microsoft Visual Basic.NET, MicroSoft Press, PHI
2. Jeffrey R. Shapiro, The Complete Reference -Visual Basic .NET, TMH
3. Murach's VB.NET database programming with ADO.NET -Anne Prince and Doug Lowe
4. Jeff Salvage, The Visual Basic.NET COACH, Addison Wesley
5. Steven Holzner, Visual Basic .NET 2003 in 21 Days. –SAMS Publications.

### **MCA595 MULTIMEDIA & ANIMATION LAB**

Flash workflow & Workspace, Working with Flash documents, Drawing Basis, Working with graphic objects, Using symbols, instances and library assets, Creating animation (Animation basics, Timeline effects, Twinned animation, Special effects, Working with text, sound & video), various masking effects

to animated images. Creating and using movie clip symbols. Organizing a movie clip timeline. Creating and using buttons. Using frame labels. Creating multiscene movies. Adding sound to frames and symbols. Playing and muting sounds. Using actions to control a timeline. using frame labels. Creating button symbols. Creating animated buttons using movie clips.

**Reference Book:**

Robert Reinhardt and Snow Dowd, Macromedia Flash - Bible

**MCA596 ENTERPRISE RESOURCE PLANNING LAB (Using SAP)**

Introduction SAP R/3 architecture, Introduction to SAP ABAP/4, Open SQL–statements, Simple reporting, Selection screens, Transaction code creation, Data Dictionary, Reporting.

Basics of Dialog Programming, Interface Programming, Scripts, SmartForms, IDOCs, ALE, EDI.

Use of SAP as a tool to access and present data, search for patterns, identify exceptions, forecast, optimize, and schedule resources.

Examine and apply techniques used in SAP R/3 for system configuration and integration with a focus on finance, materials management, sales and distribution modules.

**MCA597 SIMULATION AND MODELING LAB**

**Implementation of discrete-event simulation model in high level languages ( C / C++).**

Implementation of various distributions, Program for Parameter Estimation ,Hypothesis Testing  
C++ Implementation of an MM1 Queuing System.

Modeling other systems (two servers in series) by modifying the basic C++ implementation.

Modifying the basic program to Simulate the two servers in series.

Events and Event list,

Design of models; C++ implementation of at least one system model

Implementation of an M/M/G Queuing System.

Modified M/M/1 program with output.