

**MCA Course Structure (New 2019-20)**

**FIRST SEMESTER**

**OPEN ELECTIVE FOR OTHER DEPARTMENT**

Proposed course code	Title	Credit (L-T-P)	Mark Distribution			
			End Semester	Sessional	Practical	Total
MCAO-501	Computer Applications And Information Management*	3-1-0	80	20	-	100

Proposed course code	Title	Credit (L-T-P)	Mark Distribution			
			End Semester	Sessional	Practical	Total
MCAC-401	Discrete Mathematical Structures	3-1-0	80	20	-	100
MCAC-402	Problem Solving And Programming Using C	2-1-2	50	20	30	100
MCAC-403	Probability And Statistics	3-1-0	80	20	-	100
MCAC-404	Management Accountancy	3-1-0	80	20	-	100
MCAC-406	Digital Logics	3-1-1	50	20	30	100
<b>TOTAL CREDIT</b>			<b>22</b>			

**THIRD SEMESTER**

Proposed course code	Title	Credit (L-T-P)	Mark Distribution			
			End Semester	Sessional	Practical	Total
MCAC-501	PRINCIPLES OF PROGRAMMING LANGUAGES	3-0-1	50	20	30	100
MCAC-502	DATABASE MANAGEMENT SYSTEM – I	3-1-1	50	20	30	100
MCAC-	COMPILER	3-1-1	80	20	-	100

503	DESIGN					
MCAC-504	DATA COMMUNICATION	3-1-0	80	20	-	100
MCAC-505	COMPUTER GRAPHICS AND MULTIMEDIA	3-0-1	50	20	30	100
<b>TOTAL CREDIT</b>			<b>22</b>			

**FIFTH SEMESTER**

Proposed course code	Title	Credit (L-T-P)	Mark Distribution			
			End Semester	Sessional	Practical	Total
MCAC-601	DESIGN AND ANALYSIS OF ALGORITHMS	3-1-0	50	20	30	100
MCAE-62X	<b><i>ELECTIVE – II(Any One From The List)</i></b>	3-0-1	50	20	30	100
MCAE-621	DATA MINING					
MCAE-622	VISUAL PROGRAMMING					
MCAE-623	INTERNET AND JAVA PROGRAMMING					
MCAE-624	DESIGN & DEVELOPMENT OF EMBEDDED SYSTEMS					
MCAE-625	CLIENT / SERVER COMPUTING					
MCAE-63X	<b><i>ELECTIVE – III (Any One From The List)</i></b>	3-0-1	50	20	30	100
MCAE-631	DIGITAL SIGNAL PROCESSING					
MCAE-632	DIGITAL IMAGE PROCESSING & COMPUTER VISION					
MCAE-633	MOBILE COMPUTING					
MCAE-634	ADVANCED WEB TECHNOLOGY					
MCAE-635	ARTIFICIAL INTELLIGENCE					
MCAE-64X	<b><i>ELECTIVE –IV (Any one from the list)</i></b>	3-0-0	80	20	-	100
MCAE-641	ADVANCED COMPUTER					

	ARCHITECTURE					
MCAE-642	OPERATIONS RESEARCH					
MCAE-643	CRYPTOGRAPHY					
MCAE-644	MANAGEMENT OF SOFTWARE PROJECTS					
MCAE-645	SIMULATION AND MODELING					
MCAC-605	SYSTEM PROJECT – I	0-0-4				100
<b>TOTAL CREDIT</b>			<b>20</b>			

# MASTER OF COMPUTER APPLICATION (MCA)

## FIRST SEMESTER

### MCAO-401 COMPUTER APPLICATIONS AND INFORMATION MANAGEMENT\* (3-1-0)

**1. Basic Concepts:** Basic computer organization, Processor and memory, secondary storage devices, Input-Output devices, Computer software, Computer languages, Operating system: MS DOS, Unix (some basic commands), Data communication and computer network.

**2. Word Processing and Documentation:** Preparing and processing text documents, Basic word processing using Microsoft word or similar tools or products, Preparation of presentation slides.

**3. Fundamentals of Database Management Systems (DBMS) :** Basic Concepts of Database Entity, Attributes of entities, Database Tables, Fields, Records, Key field, Primary Key, Basic Entity Relationships, Designing database tables, data entry forms and Designing Database Reports, Introduction to DBMS package like MS-Access.

**4. Internet Services:** Concept of Internet Protocol, Internet services, Client-server organization, FTP, HTTP, Telnet, world wide web, E-mail, Domain Name System, Uniform Resource Locator, Internet Browsers, Searching the web, Search engines, Basics of HTML and web page designing.

**5. Computer Programming Basics:** C Language – Character set and Tokens of C , Control Branching and Decision-Making in C - If statement Switch statement, Looping and nesting in a loop, statements in C -while ,do while, and for statements with variations, Arrays in C - Single Two - dimensional and Multi-dimensional arrays., Handling of Character Set. User Defined Functions.

#### **Text Books**

1. Sinha, P.K., *Computer Fundamentals*, (BPB Publications, 2002).

#### **Reference Books**

1. Godbole A. S., Kahate A., *Web Technologies*, (Tata McGraw-Hill, 2006)

- \* This paper is Open (free choice) elective in nature. This course is offered by Department Of Computer Science And Engineering for students of other departments / Institutes of Rajiv Gandhi University. Students of Department of Computer Science and Engineering cannot choose this paper.

## **MCAC-401 DISCRETE MATHEMATICAL STRUCTURES (3-1-0)**

**Introduction:** Logic-Propositional Equivalences-Truth tables-Tautologies-Predicates and Quantifiers-Sets-Operations on sets-Sequences and Summations -Growth functions - relations and their properties- n-ary relations and their applications - Representation of relations-Closures of relations-Equivalence relations-Partial Orderings.

**Counting Techniques:** Basics of Counting- Pigeonhole Principle- Combinations and Permutations-Generalized Per mutations and Combinations-Recurrence relations-Solving Recurrence Relations-Divide and Conquer relations- Generating Functions-Inclusion and Exclusion-Applications of Inclusion-Exclusion.

**Graph Theory:** Introduction to Graphs-Terminology-Relations and Directed Graphs - Representations of Graphs- Isomorphism-Connectivity- Euler and Hamiltonian Paths - Shortest Path problems- Planar Graphs - Graph Coloring- Introduction to trees- Applications of trees- Traversals-Trees and sorting-Spanning Trees-Minimum Spanning Trees.

**Boolean Algebra and Models of Computation:** Boolean Functions-Representing Boolean Functions -Logic Gates-Minimizations of Circuits-Languages and Grammars-Finite State Machines with and without output-Language Recognition-Turing Machines.

### **Books/References:**

1. Discrete mathematics and its applications, Keneth. H. Rosen, Tata McGraw-Hill Publishing Company, New Delhi
2. Discrete Mathematics for computer scientists & Mathematicians, Joe L. Mott, Abraham Kandel & T. P. Baker, Prentice Hall of India Ltd, New Delhi
3. Discrete mathematics, Richard Johnsonbaug, Pearson Education, New Delhi

## **MCAC-402: PROBLEM SOLVING AND PROGRAMMING USING C (2-1-2)**

**INTRODUCTION:** Definition of Algorithms- Writing algorithms- top down design – Program verification- The efficiency of algorithms- Concept of Recursion- some simple example to illustrate these concepts like finding the GCD of two numbers- Swapping two variables- Summation of n given numbers- generation of Fibonacci sequence- Reversing a given number-Base conversion.

**INTRODUCTION TO C:** C character set- Delimiters-The C Keywords-Identifiers-Constants-Variables-Rules for Defining Variables-Data Types-Declaring Variables-Initializing Variables – Type Conversion-Priority of Operators and their Clubbing-Comma and Conditional Operator-Arithmetic Operators-Relational Operators –Logical Operators-Bitwise Operators-Input and Output in C-Formatted and Unformatted Functions -Library Functions.

**MORE ABOUT C :** if statement- if...else statement-various forms of if- nested if -break statement-continue statement – go to statement - switch statement - nested switch statement - for statement -while statement do while statement - arrays - working with string and standard functions.

ADVANCED CONCEPTS OF C : introduction to pointers – pointer declaration – Arithmetic Operations with pointers – pointers and arrays – pointers and two-dimensional arrays – array of pointers – pointers to pointers – pointers and strings – void pointers – function definition and declaration – proto types - types of functions – call by value and reference – functions returning more values – function as an argument – function with operators – function and decision statements – function and loop statements – function with arrays and pointers – recursion – pointer to function – storage classes.

ADDITIONALS IN C: preprocessor directives – structures and unions – bit wise operators – files – command line arguments – dynamic memory allocation – graphics in C .

PROBLEM SOVING: Reversal of an Array- Removal of duplicates in an ordered array- Partitioning of an array- Finding the kth smallest of an element of an array-Finding the longest monotone subsequence of an array-Linear search- Binary search- Hash searching- Bubble sort- merge sort- Quick sort-Insertion sort-selection sort-Text processing- Towers of Hanoi problem using recursion.

### **Books/References:**

1. Ashok N. Kamthane, Programming with ANSI and Turbo C, Pearson Education, New Delhi.
2. R. G. Dromey, How to Solve it by Computer, Prentice Hall Of India Ltd, New Delhi.
3. N. G. Venkateshmurthy, Programming techniques through C, Pearson Education, New Delhi.
4. Byron s Gottfried, Programming with C, Schaum's Outline series, Tata McGraw Hill Pub. Company, New Delhi.
5. Jacqueline A. jones & Keith Harrow, C programming with problem solving, Dreamtech publications, New Delhi

### **MCAC-403: PROBABILITY AND STATISTICS (3-1-0)**

**Probability:** Definitions of probability, Addition theorem, Conditional probability, Multiplication theorem, Bayes theorem of probability and Geometric probability.

**Random variables and their properties:** Discrete Random variable, Continuous Random variable, Probability Distribution joint probability distributions their properties, Transformation variables, Mathematical expectations, probability generating functions.

**Probability Distributions / Discrete distributions:** Binomial, Poisson Negative binominal distributions and their properties. (Definition, mean, variance, moment generating function., Additive properties, fitting of the distribution.)

**Continuous distributions:** Uniform, Normal, exponential distributions and their properties.

**Multivariate Analysis:** Correlation, correlation coefficient, Rank correlation, Regression Analysis, Multiple Regression, Attributes, coefficient of Association,  $\chi^2$  – test for goodness of fit, test for independence.

**Estimation:** Sample, populations, statistic, parameter, Sampling distribution, standard

error, unbiasedness, efficiency, Maximum likelihood estimator, notion & interval estimation.

**Testing of Hypothesis:** Formulation of Null hypothesis, critical region, level of significance, power of the test.

**Small Sample Tests:** Testing equality of means, testing equality of variances, test of correlation coefficient, test for Regression Coefficient.

**Large Sample tests:** Tests based on normal distribution

**Books/References:**

1. Probability & Statistics for Engineers and Scientists, Walpole, Myers, Myers, Ye. Pearson Education.
2. Probability, Statistics and Random Processes T.Veerarajan Tata McGraw – Hill
3. Probability & Statistics with Reliability, Queuing and Computer Applications, Kishor S. Trivedi, Prentice Hall of India.

**MCAC-404: MANAGEMENT ACCOUNTANCY (3-1-0)**

**Principles Of Accounting :** Nature And Scope Of Accounting, Double Entry System Of Accounting, Introduction To Basic Books Of Accounts Of Sole Proprietary Concern, Closing Of Books Of Accounts And Preparation Of Trial Balance.

**Final Accounts :** Trading, Profit And Loss Accounts And Balance Sheet Of Sole Proprietary Concern With Normal Closing Entries. (With numerical problems)

**Ratio Analysis:** Meaning, Advantages, Limitations, Types Of Ratio And Their Usefulness.(Theory only) Fund Flow Statement: Meaning Of The Term Fund, Flow Of Fund, Working Capital Cycle, Preparation and Inter-preparation Of Statement.

**Costing:** Nature, Importance and Basic Principles.

Budget and Budgetary Control: Nature and Scope, Importance Method of Finalization and Master Budget, Functional Budgets.

**Marginal Costing :** Nature, Scope, Importance, Construction Of Break Even Chart, Limitations And Uses Of Break Even Chart, Practical Applications Of Marginal Costing.

(With numerical problems)

**Introduction To Computerized Accounting System:** Coding Logic And Codes Required, Master Files, Transaction Files, Introduction To Documents Used For Data Collection, Processing Of Different Files And Outputs Obtained.

**Books/References:**

1. Introduction to Accountancy. T.S.Grewal, Sultan Chand and Sons
2. Management Accountancy, S .P.Jain
3. Introduction To Accounting, G.Agarwal.

## **MCAC-405: Digital Logics(3-1-1)**

Representation of Information:

Number System: Binary, octal, hexadecimal; Positive and negative numbers; fixed point and floating point quantities.

Arithmetic operations: Addition, subtraction.

Character codes: ASCII and EBCDIC, Redundant coding for error detection and correction: Concept of Hamming distance, parity codes, Hamming code.

Logic Design: Boolean algebra, Boolean variables and functions - canonical and standard forms, truth table, minimization of Boolean functions - Karnaugh map. Combinational logic circuits - AND, OR, NAND, NOR and NOT gates and tristate buffer; Implementation of Boolean functions using logic gates; Multiplexers, decoders; encoders, simple arithmetic and logic circuits.

Sequential circuits - flip-flops, shift registers and counters-synchronous and asynchronous.

Concept of bus and register transfer language.

Memory Devices: Semiconductor memory - RAM, ROM; Magnetic core and surface memory - disk, drum, tape; Access time and cost considerations: Concepts of volatility, random access, serial access, direct access, on-line and backup storage.

### **Books/References:**

1. Mano, M.M. : Digital Logic and Computer Design, PHI (EEE)
2. Rajaraman, V.Radhakrishnan : An introduction to Digital Computer Design.-PHI (EEE).
3. Mano, M.M. ; Computer System Architecture, PHI (EEE).
4. Hamacher, Vranesic, Zaky: Computer organization, McGraw Hill.



## THIRD SEMESTER

### **MCAC-501: PRINCIPLES OF PROGRAMMING LANGUAGES (3-0-1)**

**The Role of Programming Languages:-** Toward Higher- level Languages, Problems of Scale, Programming Paradigms, Language Implementation Bridging the Gap

**Language Description:** - Syntactic Structure: Expression Notations, Abstract Syntax Trees, Lexical Syntax, Context -Free Grammars, Grammars for Expressions, and Variants of Grammars

#### **IMPERATIVE PROGRAMMING:**

**Statements: Structured Programming:-** The Need for Structured Programming, Syntax- Directed Control Flow, Design Considerations: Syntax, Handling Special Cases in Loops, Programming with invariants, Proof Rules for Partial Correctness, Control flow in C.

**Types: Data Representation:-** The Role of Types, Basic Types, Arrays Sequences of Elements, Records: Named Fields, Unions and variant Records, Sets, Pointers: Efficiency and Dynamic Allocation, Two String Tables, Types and Error Checking.

**Procedure Activations:-** Introduction to Procedures, Parameter-passing Methods, Scope Rules for Names, Nested Scopes in the Source Text, Activation Records, Lexical Scope: Procedures as in C, Lexical Scope: Nested Procedures and Pascal.

#### **OBJECT ORIENTED PROGRAMMING:**

**Groupings of Data and Operations:-** Constructs for Program Structuring, Information Hiding, Program Design with Modules, Modules and Defined Types, Class Declarations in C++, Dynamic Allocation I C++, Templates: Parameterized Types, Implementation of Objects in C++.

**Object-Oriented Programming:-** What is an Object?, Object- Oriented Thinking, Inheritance, Object-Oriented Programming in C++, An extended C++ example, Derived Classes and information Hiding, Objects in Smalltalk, Smalltalk Objects have self.

#### **FUNCTIONAL PROGRAMMING:**

**Elements of Functional Programming:-** A little Language of expressions, Types : Values and Operations, Function declarations, Approaches to Expression Evaluation, Lexical Scope, Type Checking.

**Functional Programming in a Typed Languages:-** Exploring a List, Function Declaration by Cases, Functions as First-Class Values, ML: Implicit Types, Data Types, Exception Handling in M, Little quit in Standard ML

**Functional Programming with Lists:-** Scheme, a Dialect of Lisp, The Structure of Lists, List Manipulation, A Motivating Example: Differentiation, Simplification of Expressions, Storage Allocation for Lists.

#### **OTHER PARADIGMS:**

**Logic Programming:-** Computing with Relations, Introduction to Prolog, Data Structures in Prolog, Programming techniques, Control in Prolog, Cuts.

**An Introduction to Concurrent Programming:-** Parallelism in Hardware, Streams: Implicit Synchronization, Concurrency as interleaving, Liveness Properties, Safe Access to Shared Data, Concurrency in Ada, Synchronized Access to Shared variables.

**Books/References:**

1. Programming Languages – Concepts & Constructs , Ravi Sethi, Pearson Education.
2. Programming Languages – Design & Implementation ,Terrance W. Pratt, Marvin V. Zelkowitz, Pearson Education.
3. Concepts of Programming Languages – Robert L. Sebesta, Pearson Education.

**MCAC-502: DATABASE MANAGEMENT SYSTEM - I(3-1-1)**

1. Database Systems Concepts And Architecture:

Introduction, data models, schemas and instance; three-schema architecture and data independence; database language and interface, the database system environment; centralized and client/server architecture of DBMSs; classification of DBMSs.

2. Data Modeling Using The E-R Model:

High-level conceptual data models for database design; Entity types, entity sets, attributes and keys; relationship types, relationship sets, roles and structural constraint; weak entity types, ER diagrams, naming conventions and design issues; Notation for UML class diagrams

3. Enhanced ER and UML Modeling:

Subclasses, superclasses and inheritance; specialization and generalization; constraints and characteristics of specialization and generalization, modeling of union types using categories; representing specialization/generalization and inheritance in UML class diagrams; relationship types of degree higher than two; data abstraction, knowledge representation and ontology concepts

4. The Relational Data Model And Relational Database Constraints:

Relational model concepts, relational model constraints and relational database schemas; Updating operations and dealing with constraints violations

5. The Relational Algebra And Relational Calculus

Unary relational operations: SELECT and PROJECT; relational algebra operations from set theory; binary relational operations: JOIN and DIVISION; additional relational operations; the tuple relational calculus; the domain relational calculus

6. Relational Database Design By ER And EER-To-Relational Mapping:

Relational database design using ER-to-Relational mapping; mapping EER model constructs to relations

7. Functional Dependencies And Normalization For Relational Databases:

Informal design guidelines for relational schemas; functional dependencies; normal forms based on primary keys; general definitions of 2<sup>nd</sup> and 3<sup>rd</sup> normal forms; Boyce-Codd normal forms

### **Books/References:**

1. R. Elmasri, S.B. Navathe, “Fundamentals of Database Systems”, Pearson Education/Addison Wesley.
2. Thomas Cannolly and Carolyn Begg, “ Database Systems, A Practical Approach to Design, Implementation and Management”, Pearson Education.
3. Henry F Korth, Abraham Silberschatz, S. Sudharshan, “Database System Concepts”, McGraw Hill.
4. C.J.Date, A.Kannan and S.Swamynathan,”An Introduction to Database Systems”, Pearson Education.
5. Raghu Ramakrishnan, Johannes Gehrke, “Database Management Systems”, McGraw Hill.

### **MCAC-503: COMPILER DESIGN (3-1-1)**

Compiler structure: analysis-synthesis model of compilation, various phases of a compiler, tool-based approach to compiler construction.

Lexical analysis: interface with input, parser and symbol table, token, lexeme and patterns. Difficulties in lexical analysis. Error reporting. Implementation. Regular definition, Transition diagrams, LEX.

Syntax analysis: CFGs, ambiguity, associativity, precedence, top down parsing, recursive descent parsing, transformation on the grammars, predictive parsing, bottom up parsing, operator precedence grammars, LR parsers (SLR, LALR, LR), YACC.

Syntax directed definitions: inherited and synthesized attributes, dependency graph, evaluation order, bottom up and top down evaluation of attributes, L- and S-attributed definitions.

Type checking: type system, type expressions, structural and name equivalence of types, type conversion, overloaded functions and operators, polymorphic functions.

Run time system: storage organization, activation tree, activation record, parameter passing, symbol table, dynamic storage allocation.

Intermediate code generation: intermediate representations, translation of declarations, assignments, control flow, Boolean expressions and procedure calls. Implementation issues.

Code generation and instruction selection: issues, basic blocks and flow graphs, register allocation, code generation, dag representation of programs, code generation from dags, peep hole optimization, code generator generators, specifications of machine.

### **Books/References:**

1. V. Aho, R. Sethi, and J. D. Ullman: Compilers: Principles, Techniques and Tools, PEARSON Education.
2. C. Fischer and R. LeBlanc: Crafting a Compiler in C , PEARSON Education.
3. Holub: Compiler Design in C, PHI
4. Andrew W. Appel and Maia Ginsburg: Modern Compiler Implementation in C, Cambridge Press.

## **MCAC – 504: DATA COMMUNICATION (3-1-0)**

Overview: Objectives and Applications of Computer Communication. Computer Communication Network Architecture: ISO-OSI reference model, design philosophy, layer, protocol, interface, and service concepts. Layer-wise functionality. Physical Layer: Concepts of data transmission, modulation and multiplexing methods, modem, encoding methods, communication media, standard protocols, RS-232C, RS-449, X.21.

Medium Access Control in broadcast networks: ALOHA, CSMA, CSMA/CD, token ring, token bus, Standard LAN Protocols (IEEE 802.X), FDDI, satellite networks. Data link layer: Framing, error control techniques, data link protocols and their performance, SDLC protocol.

Network layer: Routing, Congestion and deadlock control Algorithms, Internetworking issues and devices, gateways, bridges and routers, IP & X.25 protocols.

### **Books/References:**

1. Tanenbaum A.S., Computer Network, PHI (EEE).
2. Behrouz A. Forouzan: Data Communications and Networking, Tata McGraw Hill.
3. William Stallings: Data and Computer Communication, Pearson Education.
4. Alberto Leon-Garcia and Indra Widjaja: Communication Networks -Fundamental Concepts and Key Architectures, Tata McGraw-Hill.

## **MCAC-505: COMPUTER GRAPHICS (3-0-1)**

Introduction: Display of entities, Geometric computation and representation, Graphics Environments; Working Principles of display devices: refreshing raster scan devices, vector devices, Cathode Ray Tube Terminals, Plotters; Display of colors: Look Up Tables, display of gray shades, Half toning;

Display and drawing of graphics primitives: point, line, polygon, circle, curves and text;

Coordinate Conventions: world coordinates, device coordinates, normalized device coordinates, view-port and window, zooming and panning by changing coordinate reference frames; Computations on polygons: point inclusion problem, polygon filling, polygon intersection, clipping, polygonization of a point set, convex hull computation, triangulation of polygons; Transformations in 2D and 3D: translation, rotation, scaling, reflection, Projection: perspective and parallel projections, isometric projection, Transformation matrices;

Volume and Surface Representation: polygonal meshes, parametric curves and surfaces, Cubic and Bicubic Splines, Voxel, Octree and Medial Axis representation, Sweep Representation, Surfaces and Volumes by rotation of curves and surfaces, fractal modeling;

Hidden surface and line elimination: Elimination of back surfaces, painters' algorithms, Binary Space Partitioning Tree; Rendering and Visualization: Shading model, Constant,

Goraud and Phong Shading, Ray tracing algorithm, Radiosity Computation; Computer Animation: fundamental concepts.

**Books/References:**

1. James D. Foley, Andries Van dam, Steven K. Feiner & John F. Hughes, Computer Graphics – Principles and Practices, Pearson Education.
2. Donald Hearn and M Pauline Baker, Computer Graphics, PHI
3. Woo, Neider, Davis, Shreiner, “Open GL Programming Guide”, Pearson Education.
4. David F. Rogers, Procedural Elements for Computer Graphics, Tata-McGraw Hill.

## FIFTH SEMESTER

### **MCAC-601: DESIGN AND ANALYSIS OF ALGORITHMS (3-1-0)**

Elementary Data Structures, Basic Computational Models.

Simple Algorithms. Analyzing Algorithms, Asymptotic Notation, Recurrence relations.

**Design Methods** : General Consideration, Algorithm design paradigms and representative problems: Divide and Conquer (Binary search, Merge Sort, Quick Sort, Arithmetic with Large integers, etc.), Greedy Method (Minimal Spanning Tree, Shortest Paths, Knapsack, etc.), Dynamic Programming (Chained Matrix Multiplication, Optimal Storage on Tapes, Shortest Paths, Optimal Search Trees, etc.), Backtracking (8-queens problem, Graph Colouring, Hamiltonian Cycles, etc.), Branch and Bound (0/1 Knapsack problem, Travelling Salesperson, etc.), Approximation (Graph Colouring, Task Scheduling, Bin Packing, etc.), Probabilistic Algorithms (Numerical Integration, Primality Testing, etc.).

Polynomial Evaluation and Interpolation, Fast Fourier transforms.

**Intractable Problems:** Basic Concepts, Nondeterministic Algorithms, NP Completeness, Cook's Theorem, Examples of NP-Hard and NP-Complete problems. Problem Reduction.

Lower Bound Techniques: Comparison tree, Reduction, Adversary argument.

#### **Books/References:**

1. Aho, J. Hopcroft and J.Ullman, The design and Analysis of Computer Algorithms, Addison Wesley.
2. E. Horowitz and S. Sahani, Fundamentals of Computer Algorithms, Galgotia, New Delhi.
3. S.E. Goodman and S.T. Hedetniemi, Introduction to the Design and Analysis of Algorithms, McGraw Hill.
4. G. Brassard and P.Bratley, Algorithmics, PHI.
5. S.K. Basu, Design Methods and Analysis of Algorithms, PHI.
6. T.H. Cormen, et. al, Introduction to Algorithm, PHI.

### **MCAE-621: DATA MINING (3-0-1)**

Introduction: Basic Data Mining Tasks, Data Mining Issues, Data Mining Metrics, Data Mining from a Database Perspective. Data Mining Techniques: A Statistical Perspective on Data Mining, Similarity Measures.

Decision Trees, Neural Networks, Genetic Algorithms. *Classification:* Distance-Based Algorithms, Decision Tree-Based Algorithms.

Clustering: Similarity and Distance Measures, Partitional Techniques, Hierarchical Techniques, Density based Techniques, Clustering Large Databases, Clustering with Categorical Attributes.

Association Rules: Basic Algorithms, Parallel and Distributed Algorithms, Incremental Rules, Advanced Association Rule Techniques.

Advanced Techniques: Web Mining, Spatial Mining, Temporal Mining, Text Mining, and Applications of Data mining.

### **Books/References:**

1. Jiawei Han and Micheline Kamber, 'Data Mining: Concepts and Techniques, Morgan Kaufmann, India
2. A K Pujari, 'Data Mining Techniques, University Press, India
3. Han, Manilla and Smyth, 'Principles of Data Mining', PHI, India
4. Pang-ning Tan, Michael Steinbach, Vipin Kumar , Introduction To Data Mining, Pearson, 1st Edition, 2007.

### **MCAE-622 VISUAL PROGRAMMING(3-0-1)**

**Introduction to visual programming** - Concept of event driven programming – Introduction to VB .Net environment, The .NET Framework and the Common Language Runtime. Building VB.NET Applications, The Visual Basic Integrated Development Environment. Forms- properties, events. The Visual Basic Language-Console application and windows application, Data types, Declaring Variables, scope of variables, operators and statements.

Making Decisions with *If...Else* Statements, Using Select Case, Making Selections with *Switch* and *Choose*, *Loop statements - Do Loop, for, while- The With Statement- Handling Dates and Times- Converting between Data Types- Arrays – declaration and manipulation- Strings & string functions - Sub Procedures and Functions.*

Windows Applications-Forms- Adding Controls to Forms, Handling Events, *MsgBox* , *InputBox* , Working with Multiple Forms, Setting the Startup Form, SDI & MDI Forms, Handling Mouse & Keyboard Events, Common controls (Text Boxes, Rich Text Boxes, Labels, Buttons, Checkboxes, Radio Buttons, Group Boxes, List Boxes, Checked List Boxes, Combo Boxes, Picture Boxes, Scroll Bars, Tool Tips, Timers) - properties – methods

Object-Oriented Programming - Creating and using Classes & objects - Handling Exceptions- *On Error GoTo*- Raising an Exception- Throwing an Exception- Using Structured Exception Handling – Debugging and tracing

Data Access with ADO.NET- Accessing Data with the Server Explorer- Accessing Data with Data Adaptors and Datasets- Creating a New Data Connection- Creating and populating Dataset- Displaying Data in a Data Grid- Selecting a Data Provider- Data Access Using Data Adapter Controls- Binding Data to Controls- Handling Databases in

Code – Binding to XML data

**VISUAL C++ PROGRAMMING:** VC++ Components – Microsoft foundation Classes – Event Handling – Document View architecture – Menus – Dialog Boxes – Using VBX Controls – Using ActiveX Controls – Reading and Writing documents – SDI and MDI environments.

Splitter windows and Multiple views - MFC File Handling – Exception Handling – Debugging – Object Linking and Embedding – DLL – Database Management with ODBC.

### **Text Books:**

1. Visual Basic .NET Black Book, by Steven Holzner
2. Charles Petzold, “ Windows Programming”, Microsoft Press, 1999.
3. Steven Holzner, “Visual C++ Programming”, Second Edition, PHI Publishers, 1997.

### **References:**

1. VB.NET for developers, By Keith Franklin, Rebecca Riordan, SAMS.
2. Sams Teach Yourself Visual Studio .NET 2005 in 21 Days, By Jason Beres
3. Learning Visual Basic .NET by Jesse Liberty
4. Visual Basic .Net programming in easy steps BY TIM ANDERSON, DreamTech Press

## **MCAE-623 INTERNET AND JAVA PROGRAMMING(3-0-1)**

AIM: To Study about Internet, Core java. Java swing,JDBC,Java Beans and Sewlets

Internet: Internet- Connecting to Internet: Telephone- Cable- Satellite connection- Choosing an ISP- Introduction to Internet Services- E-mail Concepts- Sending and Receiving secure E-mail- Voice and Video Conferencing.

Core Java: Introduction- Operators- Data types- Variables- Arrays- Control Statements- Methods & Classes- Inheritance- package and interface- Exception handling- Multithread programming- I/O- Java Applet- String handling- Networking- Event Handling- Introduction to AWT- AWT controls- Layout managers- Menus- Images- Graphics.

Java swing: Creating a swing Applet and Application- Programming using Panes- Pluggable Look and feel- Labels- Text fields- Buttons- Toggle Buttons- Checkboxes- Radio Buttons- View Ports- Scroll Panes- Scroll Bars- List- Combo Box- Progress bars- Menus and Toolbars- Layered Panes- Tabbed Panes- Split Panes- Layouts- Windows- Dialog Boxes- Inner frame.

JDBC: The connectivity Model- JDBC/ODBC Bridge- Java.sql package- connectivity to remote database- navigating through multiple rows retrieved from a database.

Java Beans: Application Builder tools- The bean developer kit(BDK)- JAR files-



Introduction- Developing a simple bean- using bound properties- The java Beans API- Session Beans- Entity Beans- Introduction to Enterprise Java Beans(EJB)- Introduction to RMI(Remote Method Invocation): A simple client-server application using RMI.

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

#### TEXT BOOKS

1. Margaret Levine Young, “The Complete Reference Internet”, TataMc-Graw Hill 1999
2. Herbert Schidt, “The Complete Reference JAVA2”, TataMc-Graw Hill 5<sup>th</sup> edition,2002

#### REFERENCES

- 1 Balagurusamy E., “Programming with A Perimer 3e Java”, TataMc-Graw Hill, 2007.
- 2 Dustin R. Callway, “Inside Servlets”, Addison Wesley.,1999
3. Mark Watka “Using Java 2 Enterprise Edition”, Que, 1<sup>st</sup> edition,2001
4. Setven Holzner, “Java2 Black Book”-Coriolis Group Books,2001

### **MCAE-624DESIGN & DEVELOPMENT OF EMBEDDED SYSTEMS(3-0-1)**

Introduction to Embedded Systems(ES), their examples and applications. Concept, Definition and Classification. Advanced hardware fundamentals. Criteria for Processor and Memory Selection for ES.

Interrupts- Basics, Shared-Data Issues, Latency. ES software architectures. Round-Robin with interrupts; Function-Queue scheduling. Issues of context, latency and deadline.

Introduction to Real-Time Operating Systems(RTOS). Tasks, Task States, Semaphores and Shared Data. Use of OS services e.g. Timer functions, Message Queues, Events, Pipes and ISRs.

Discussion of basic design using RTOS and examples. Hard Real-Time scheduling considerations. Memory and power conservation. Embedded Software Development tools: Host/Target machines, Linker/Re-Locator, Debugging Techniques.

Case study of Programming (at least one) industry-standard RTOS e.g. Micro-C/OS , VxWorks, (Embedded) Linux. Detailed study of its services and use of its API.

#### **References:**

David Simon, “An Embedded Software Primer”, Pearson (Asia).

Raj Kamal, ”Embedded Systems – Architecture, Programming & Design”, TMH.

Qing Li, “Real-Time Concepts for Embedded Systems”, CMP.

Arnold Berger, “Embedded Systems Design – An Introduction to Processes, Tools & Techniques”, CMP.

## **MCAE-625 CLIENT / SERVER COMPUTING(3-0-1)**

### **INTRODUCTION**

Client Server computing and its Characteristics-Client Server Architecture-Benefits of Client Server Computing-Hardware Trends-Software Trends-Components of Client Server Applications-Classes of Client Server Applications-Categories of Client Server Applications.

### **THE CLIENT**

Role of the Client-Client Components-Client Services-Client Operating Systems-GUI-GUI Environments-GUI Design Standards-Open GUI Standards-Database Access and Tools- Interface Independence-Testing Interfaces-Development Aids.

### **THE SERVER**

Role of the Server-Server Functionality in Detail-Features of Server Machines-Classes of Server Machines-Layers of Software-Network Management Environment-Network Computing Environment- Server Operating System-Transaction Processing-Connectivity-Intelligent Database-Stored Procedures-Triggers-Load Leveling-Optimizer-Testing and Diagnostic Tools-Reliability-Backup and Recovery Mechanisms-Data Management Software.

### **THE NETWORK**

Layers- Interfaces and Protocols –Standard Architectures- Network Characteristics - Network Management Standards - LAN Characteristics - LAN Hardware-Network Operating Systems.

### **DEVELOPMENT METHODOLOGY AND TOOLS**

Convert Existing Screen Interfaces-Re\_Engineering Existing Applications-Business Re\_Engineering-MethodologyTools-EASELWorkbench-Ellipse-SQLWindowPowerBuilder-SQLToolset-Future of Client Server Computing.

### **TEXT BOOK:**

1. Dawna Travis Dewire ,” Client/ Server Computing”, Tata McGraw Hill, 2003.

### **REFERENCES:**

1. Patric Smith and Steve Guengerich,” Client /Server Computing”,Second Edition,PHI,1997.
2. Robert Orfali, Dan Harkey, Jeri Edwards,” The Essential Client/ Server survival Guide”, Second Edition,Galgotia 1999.

## **MCAE-631: DIGITAL SIGNAL PROCESSING (3-0-1)**

Discrete-time signals and systems.

Difference equations, z-transform.

Discrete-time processing of continuous-time signals, sampling, A/D and D/A, decimation and interpolation.  
Transform analysis of linear time-invariant systems.

Structures of discrete time systems.

Filter design techniques.

Discrete Fourier series, DTFT, DFT, DFT properties, efficient computation of DFT, FFT, Goertzel algorithm, Chirp transform, decimation in time and decimation in frequency, DCT.

Short-time Fourier analysis and filter banks.

Hilbert transform, Cepstral analysis, Linear prediction.

### **Books/References:**

1. J.G. Proakis, Digital Signal Processing: Principles, Algorithms, And Applications , Pearson, 4<sup>th</sup> Edition, 2011.
2. Oppenheim, Digital Signal Processing, Pearson, 1<sup>st</sup> Edition, 2006.
3. S Sallivahanan, Digital Signal Processing , Tata McGraw-Hill, 2<sup>nd</sup> Edition, 2011
4. Ashok Ambardar, Analog and Digital Signal Processing, CL Engineering, 2<sup>nd</sup> Edition, 1999

## **MCAE-632: DIGITAL IMAGE PROCESSING & COMPUTER VISION (3-0-1)**

Introduction to Image Processing & Computer Vision: Fundamentals, Purpose, Application, Image processing system components, image sensing & Acquisition, sampling & Quantization. Neighbors of a pixel adjacency connectivity, regions & boundaries, Distance Measures, stereo vision.

Image Formation: Monocular imaging system, Orthographic & Perspective Projection, Camera model and Camera calibration, stereo and multi view geometry, Binocular imaging systems.

Image Enhancement & Restoration: Spatial filtering: Intensity transformations – piece-wise linear transformations, bit plane slicing, histogram equalization, smoothing filtering masks, sharpening filters – gradient operators and Laplacian filters. Frequency domain filtering: Image sampling, 2D Discrete Fourier Transform, lowpass filtering ideal and Gaussian, highpass filtering- ideal, Gaussian, Laplacian. Noise Models. Mean, median and min-max filters. Minimum mean square error filter.

Colour Image Processing: Colour models, pseudocolour, image processing, colour transformation, segmentation.

Wavelets and Multi resolution Processing: Image pyramids, subband coding, Harr transform, multi resolution expansions, discrete and continuous wavelet transforms

Image Compression: Fundamentals, Basic compression methods – Huffman, Arithmetic, LZW, run length coding schemes, Error free & Lossy compression, Standards: JPEG, JBIG

Edge and Boundary Detection: Edge detection, boundary detection, edge detection performance, boundary detection performance.

Morphological Image Processing: Erosion and dilation, opening and closing, boundary extraction, hole filling.

Motion Estimation, Detection & Tracking: Regularization theory, optical computation, Motion estimation, Structure from motion.

Shape Representation & Reconstruction: Deformable curves and surfaces, Snakes and active contours, Level set representations, Fourier and wavelet descriptors, Medial representations, Multiresolution analysis.

### **Books/References:**

1. Rafael C. Gonzalez & Richard E. Woods, Digital Image Processing, Pearson Education.
2. D.Forsyth, J Ponce, Computer Vision – A Modern Approach, Prentice Hall, India
3. Anil K Jain, Fundamentals of Digital Image Processing, Prentice Hall India
4. E.Trucco, A Verri, Introductory Techniques for 3-D Computer Vision, Prentice Hall.

### **MCAE-633: MOBILE COMPUTING (3-0-1)**

Introduction: Cellular networks, wireless LANs, application adaptation.

Cellular Overview : Cellular concepts, location management, handoffs.

Wireless LAN overview : MAC issues, mobile IP, ad hoc networks, TCP issues.

Applications overview : wireless applications, disconnected operations, data broadcasting, mobile agents.

GSM : Air-interface, channel structure, timing, architecture.

WAP: Architecture, protocol stack, application environment.

TCP: Asymmetric links, wireless errors, handoffs; i-tcp, snoop, link rxmit, m-tcp.

Ad hoc networks: MAC, routing, transport.

Routing: Virtual backbone, Kelpi, mobile-IP.

Data broadcasting : Push-pull, consistency.

Location management : HLR-VLR, hierarchical.

Access Technologies: Blue Tooth, GPRS, IEEE 802.11, CDMA.

QoS in Wireless

**Books/References:**

1. Schiller, Mobile Communications, Pearson, 2<sup>nd</sup> Edition, 2008
2. Mobile Communications, V. Jeyasri Arokiamary, Technical Publications, 1st Edition
3. Mobile Computing, Kumkum Garg, Pearson, 1st Edition, 2010
4. Mobile Computing, Raj Kamal, Oxford University Press, Usa, 1st Edition, 2008
5. Mobile Computing: Technology, Application and Service Creation, Asoke K Talukder, Hasan Ahmed, Roopa Yavagal, Tata Mcgraw Hill Education Private Limited, 2nd Edition, 2010

**MCAE-634: ADVANCED WEB TECHNOLOGY (3-0-1)**

1. Introduction to advanced web technology - Mark-up language technology (XML structures and tools), Advanced web technologies (such as AJAX and advanced web security), Searching and pattern matching using regular expressions, Issues and challenges of modern Web Technologies and Web 2.0, Advanced web topics (such as web services and Unicode)
2. Technological issues: XML processing, RDF processing
3. Taxonomies and ontologies for advanced web applications: Ontology modelling, Languages for representing ontologies on the web, Rules and inferences
4. Web services: Design and modelling of web services, Technologies for implementing web services
5. Current applications of advanced web technologies

**Books/References:**

1. Semantic Web Primer, Semantic Web Primer, MIT Press, 2nd Edition, 2010
2. Semantic Web Technologies: Trends and Research in Ontology-based Systems by John Davies, Rudi Studer, and Paul Warren John Wiley & Son's
3. Web Technologies: A Computer Science Perspective by Jeffrey C. Jackson, Prentice Hall, 2006.

**MCAE-635: ARTIFICIAL INTELLIGENCE (3-0-1)**

Introduction: AI problem; AI techniques, problem as a state space search, Production Systems, Issues in design of search programs.

Heuristic Search Techniques: Generate and test, Hill Climbing, Best-First Search, Problem reduction, Means- Ends analysis.

Knowledge Representation: Knowledge representation issues, Predicate logic, knowledge representation using rules, weak slot-and-Filler structure.

Natural Language Processing: Syntactic processing, semantic analysis, Discourse and pragmatic processing.

Expert Systems: Representation using domain knowledge, Expert System shell, knowledge acquisition.

**Books/References:**

1. Artificial Intelligence: E. Rich & K. Knight, Tata McGraw Hill.
2. Principles of Artificial Intelligence, N.J. Nilson, Narosa Pub. House.

**MCAE-641: ADVANCED COMPUTER ARCHITECTURE (3-0-0)**

Introduction: review of basic computer architecture, quantitative techniques in computer design, measuring and reporting performance. CISC and RISC processors.

Pipelining: Basic concepts, instruction and arithmetic pipeline, data hazards, control hazards, and structural hazards, techniques for handling hazards. Exception handling. Pipeline optimization techniques. Compiler techniques for improving performance.

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, superscalar, superpipelined and VLIW processor architectures. Array and vector processors. Multiprocessor architecture: taxonomy of parallel architectures.

Centralized shared-memory architecture: synchronization, memory consistency, interconnection networks. Distributed shared-memory architecture. Cluster computers.

Non von Neumann architectures: data flow computers, reduction computer architectures, systolic architectures.

**Books/References:**

1. Hennessey and Patterson: Computer Architecture A Quantitative Approach, Elsevier.
2. Kai Hwang: Advanced Computer Architecture - Parallelism, Scalability, Programmability, Tata McGraw Hill.

## **MCAE-642: OPERATIONS RESEARCH(3-0-0)**

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

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

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

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

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

Integer Programming : Branch and Bound Algorithms cutting plan algorithm.

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

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

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

**Books/References:**

1. Operations Research– An Introduction, Handy A Taha, Pearson Education.
2. Operations Research, Panneer Selvan, PrenticeHall of India.
3. Operation Research, Hira and Gupta, S.Chand

## **MCAE-643: CRYPTOGRAPHY(3-0-0)**

Introduction to Cryptography: Terminology, Security Aspects, Attack Models, Classical Cryptography, Shift Cipher, Substitution Cipher, Vigenere Cipher, Basic Cryptanalysis

Mathematics of Cryptography: Groups, Rings, and Fields, Integer Arithmetic, Modular Arithmetic, The Euclidean Algorithm, Finite Fields of The Form  $GF(p)$ , Polynomial Arithmetic, Finite Fields Of the Form  $GF(2^n)$ , Linear Congruence

Introduction to Number Theory: Prime Numbers, Primality Testing, Factorization, Fermat's and Euler's Theorems, Testing for Primality, The Chinese Remainder Theorem, Discrete Logarithms

Conventional Encryption: Attacks on Encryption Schemes, Perfect Security, Cipher Machines, Modes of Operation (ECB, CBC, CFB, OFB) , Multiple Encryption , DES, Triple-DES, AES,RC4 Stream Cipher , Attacks on DES.

Pseudo-random Number Generators (PRNGs): Random and Pseudorandom Numbers, Next-bit Test, Removing Biases, ANSI X9.17 Generator Blum-Blum-Shub Generator, Statistical Tests.

Hash Functions and MAC: Standard hashes (MD5, SHA-1, SHA-256/384/512, RIPEMD-160), Birthday Attack , Collisionfreeness and recent attacks , Message Authentication Code (MAC) Algorithms , Authenticated Encryption

Key Establishment and Public-key Cryptography: Key Management, Diffie-Hellman Key Exchang ,Attacks on Diffie Hellman, RSA, Attacks on RSA , ElGamal , Attacks on ElGamal , Semantic Security and Chosen-ciphertext Security, Provably Secure Schemes

Integrity and Digital Signature: Message Integrity, Digital Signature, Authentication Protocol, Digital Signature Standards, Attacks on Digital Signature, Variation and Applications

### **Books/References:**

1. William Stallings, Cryptography and Network Security, Principles and Practice, Prentice Hall India.
2. Behrouz A Forouzan, Cryptography & Network Security, Tata McGraw-Hill Publications
3. Atul Kahate, Cryptography and network security, TMGH

### **MCAE-644: MANAGEMENT OF SOFTWARE PROJECTS (3-0-0)**

#### UNIT I ( 12 Hours)

Managerial Issues in Software Projects: Introduction to software markets; Planning of software projects; Size and Cost Estimations; Project Scheduling; Measurement of software quality and productivity; ISO and Capability Maturity Models for organisational growth. Project management and Practice.

#### UNIT II ( 12 Hours)

Managing the systems life cycle; requirements determination, logical design, physical design. testing, implementation; system and database integration issues; metrics for project management and systems performance evaluation, managing expectations; superiors. users. team members. and other related to the project; determining skill requirements and staffing the project; cost-effectiveness analysis; reporting and presentation techniques; and effective management of both behavioural and technical aspects of the project.

#### UNIT III ( 12 Hours)

Activity Planning ;Creating Framework ; Collecting The Data ; Visualizing Progress ; Cost Monitoring ;Earned Value ; Priortizing Monitoring ; Getting Project Back To Target ; ChangeControl ; Managing Contracts ; Introduction ; Types Of Contract ; Stages In ContractPlacement ; Typical Terms Of A Contract ; Contract Management ; Acceptance.

#### UNIT V ( 10 Hours)

Managing People And Organizing Teams ;Introduction ; Understanding Behavior ; Organizational Behaviour: A Background ;Selecting The Right Person For The Job ; Instruction In The Best Methods ; Motivation; The Oldman - Hackman Job Characteristics Model ; Working In Groups ; BecomingA Team ;Decision Making ; Leadership ; Organizational Structures ; Stress ;HealthAnd Safety ; Case Studies.

**TOTAL: 46 HOURS**



## **Text Book**

1. Bob Hughes, Mikecoterrell, "Software Project Management", Fifth Edition, Tata McGraw Hill, 2011.

## **References:**

1. Gilb, T., "Principles of Software Engineering Management", Addison Wesley. Reading. M.A 1988.
2. Putnam. L.H . Myers. W., "Industrial Strength Software: Effective Management Using Measurement ". IEEE C.S. Press. 1997.
3. Ramesh, Gopalswamy, "Managing Global Projects", Tata McGraw Hill, 2001.
4. Royce, "Software Project Management", Pearson Education, 1999.

## **MCAE-645: SIMULATION AND MODELING (3-0-0)**

Definition of System: Types of systems- continuous and discrete; Modelling process and definition of a model; Verification and validation of a modeling procedure; Comparing model data with real system data; Differential and partial differential equation models; Combining discrete event and continuous models.

Simulation process; Discrete and continuous simulation methods.

Use of database and AI techniques in the area of modeling and simulation.

## **Books/References:**

1. Gordon, G: System Simulation, Prentice Hall.
2. Payer, T.A: Introduction to Simulation, McGraw Hill.
3. Reitman, J: Computer Simulation Application, Wiley.
4. Spriet, W.A.: Computer Aided Modelling and Simulation , Academic Press.