

**MATHEMATICS & COMPUTER APPLICATIONS  
DEPARTMENT**

**MASTER OF COMPUTER APPLICATION (MCA)**

**Course of Study & Scheme of Examination  
2016-17**



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# Maulana Azad National Institute of Technology, Bhopal (M.P.)

## MCA (MASTER IN COMPUTER APPLICATIONS)

### I SEMESTER

Subject Code	Subjects	Periods per Week			Total Credits
		L	T	P	
MCA511	Mathematics-I	3	---	---	3
MCA512	Computer Organization & Architecture	3	---	---	3
MCA513	Data Structure	3	---	4	5
MCA514	Operating System	3	---	---	3
MCA515	Programming through C & C++	3	---	---	3
MCA516	Programming Lab - I	---	---	10	5
	Total	15	---	14	22

### II SEMESTER

Subject Code	Subjects	Periods per Week			Total Credits
		L	T	P	
MCA521	Mathematics-II	3	---	---	3
MCA522	Advance Computer Architecture	3	---	---	3
MCA523	Software Engineering	3	---	4	5
MCA524	Principles of Programming Languages	3	---	---	3
MCA525	Theory of Computation	3	---	---	3
MCA526	Programming Lab - II	---	---	10	5
	Total	15	---	14	22

### III SEMESTER

Subject Code	Subjects	Periods per Week			Total Credits
		L	T	P	
MCA611	Mathematics-III	3	---	---	3
MCA612	Unix & its Internal	3	---	2	4
MCA613	Windows Programming & Scripting Languages	3	---	---	3
MCA614	Analysis & Design of Algorithm	3	---	---	3
MCA615	Database Management System	3	---	---	3
MCA616	Minor Project - I	---	---	12	6
	Total	15	---	14	22

#### IV SEMESTER

Subject Code	Subjects	Periods per Week			Total Credits
		L	T	P	
MCA621	Computer Oriented Optimization	3	---	---	3
MCA622	Computer Networks	3	---	2	4
MCA623	Compiler Design	3	---	---	3
MCA624	Distributed Systems	3	---	---	3
MCA625	Web Based Applications Development	3	---	---	3
MCA626	Minor Project - II	---	---	12	6
	Total	15	---	14	22

#### V SEMESTER

Subject Code	Subjects	Periods per Week			Total Credits
		L	T	P	
MCA711	Computer Graphics	3	---	2	4
MCA712	Intelligent Systems	3	---	---	3
MCA713	Mobile Application Development	3	---	---	3
MCA731-735	Elective – I	3	---	---	3
MCA741-745	Elective – II	3	---	---	3
MCA714	Minor Project - III	---	---	12	6
	Total	15	---	14	22

#### VI SEMESTER

Subject Code	Subjects	Periods per Week			Total Credits
		L	T	P	
MCA721	Final Dissertation (Major Project)	--	---	30	30
MCA722	Seminar/Presentation (Major Project)	---	---	10	10
	Total	---	---	---	40

#### LIST OF ELECTIVES

MCA-731 Data Warehousing and Mining  
MCA-732 Advanced Software Engineering  
MCA-733 Advanced RDBMS  
MCA-734 Information Retrieval  
MCA-735 Natural Language Processing

MCA-741 Multimedia Computing  
MCA-742 Parallel Computing  
MCA-743 Cloud Computing  
MCA-744 Image Processing  
MCA-745 Neural Network & Fuzzy Logic  
MCA-746 Next Generation Networks

# **MASTER OF COMPUTER APPLICATIONS (MCA)**

## **FIRST SEMESTER**

### **MCA – 511 MATHEMATICS- I**

Logic Propositions and Logical Operations, First Order Predicate Logic, Fuzzy Sets, Fuzzy Relations, Properties and Operations on Fuzzy Relations. Relations, Equivalence Relations, Posets, Lattices, Complemented Lattices, Sub Lattices. Distributive and Modular Lattices. Boolean Algebra, Group Theory. Graph Theory Directed and Undirected Graphs, Connectedness Algorithms, Shorter Path. Algorithm Euclidian and Hamiltonian Graphs, The Travelling Salesman Problem, Trees: Spanning Trees, Rooted Trees and Binary Trees. Discrete Numeric Functions, Generating Functions, Recursion and Recurrence Relation, Coding Theory, Binary Symmetric Channel, Coding Process, Decoding, Error Detection and Correction Codes. Vector Spaces, Linear Mapping, Linear In-Equality, Inner Products, Norms.

**References:** “Applied Discrete Structures For Computer Science”, Alan Doerr & Kenneth Levasseur, Science Research Associates; “Discrete Mathematical Structures For Computer Science”, Bernard Kolman & Robert C. Busby, Prentice-Hall; “Discrete Mathematical Structure with applications to Computer Science”, J.P.Trembley & R.P.Manohar, McGraw Hill;

### **MCA - 512 COMPUTER ORGANIZATION & ARCHITECTURE**

Fundamentals of Computer & Logic Circuits, Register Transfer and Micro Operations, Input-Output Organization, Memory Hierarchy and Memory Management Schemes & Hardware, Pipeline and Vector Processing, Introduction of Microprocessors, Introduction to 8085 Architecture and Its Extension to 8086, First Generation and Modern Second Generation Processors and Its Comparative Study.

**References:** “Computer System Architecture”, M. Mano, Prentice-Hall; “Advanced Computer Architecture”, Kai Hwang, Tata McGraw-Hill; “Digital Electronics”, Malvino & Leach, McGraw Hill;

### **MCA – 513 DATA STRUCTURE**

Introduction to Data Structure, Primitive and Abstract Data Types, Complexity Analysis, Abstract Data Types, Linear Data Structures: Stacks, Queue, Linked List; Non-Linear Data Structures Trees, Graph, Searching & Sorting Techniques.

**References:** “An introduction to data structures and algorithms”, Tremblay & Sorenson, Addison Wesley; “Data Structures Using C”, Aaron M. Tenenbaum, Prentice Hall; “Introduction to Data Structures”, Bhagat Singh & Thomas Naps, West Publishing Company; “Fundamentals of Data Structures”, Ellis Horowitz & Sartaj Sahni, Computer Science Press;

### **MCA - 514 OPERATING SYSTEM**

Fundamental Concepts of Operating System, Process & Processor Management, Deadlock Handling, Concurrent Processes, Memory Management, File Systems, Device Management, Distributed Systems. Case Studies: Unix, Windows, Linux, Mac.

**References:** "Operating System Principles", A. Silberschatz, PB Galvin & G. Gagne, wiley india; "Internal structure of window 95", N.Zipps, PHI; "Operating System" , James L. Patterson, Addison Wesley; "Opearting Systems", Nutt G, Addison Wesley Addison Wesley;

### **MCA- 515 PROGRAMMING Through C & C++**

Programming concepts, Data Types, Decision Making and Loop constructs, Arrays, Structures, Pointers, Functions, File Handling, Pointers, Structures, Principles of Object oriented programming, Classes and objects, Polymorphism, Inheritance, Templates, Exception and File Handling,

**References:** "Complete reference in C", Herbert Schield, TMH; "Let us C", Yashwant Kanetkar, BPB; "An introduction to object-oriented programming", Timothy Budd, Addison-Wesley; "Mastering C++", KR Venugopal & Rajkumar, TMH;

### **MCA-516 Programming Lab – I**

The students have to carry out assignment work from papers MCA511, MCA 513 & MCA 515.

## **SECOND SEMESTER**

### **MCA–521 MATHEMATICS- II**

Finite Difference, Interpolation and Extrapolation, Inverse Interpolation, Numerical Differentiation Numerical Integration, Gauss-Legendre, Monte Carlo Methods of Integration, Numerical Solution of Ordinary Differential Equations of First And Second Order, Solution of Simultaneous Differential Equation, Solution of Algebraic and Transcendental Equation Solution of Non-Linear Equations. Solution of Linear Simultaneous Equations, Fourier Transform, Sine and Cosine Transform, Laplace Transformation of Elementary Functions, Inverse Transform, Solution of Ordinary Differential Equations Using Laplace Transform Techniques

**References:** "Numerical Algorithms", B.S. Grewal, Khanna Publications; "Numerical Algorithms EWP", Krishnamutry & Sen;"Numerical Methods for Scientists & Engineers" M.K. Jain & Iyengar; "Simulation and Modeling" Gordan, PHI; "Advanced Engineering Mathematics" Erwin Kreyszig, Wiley;

### **MCA-522 ADVANCED COMPUTER ARCHITECTURE**

Review of General Concepts of Computer System Architecture, Overview of Modern Processor Architectures PRAM and VLSI Models, Multiprocessors and Multicomputer. Multivector and SIMD Computers, PRAM and VLSI Models, Basic Parallel Processing Architecture, Taxonomy-SSID.MISD, SIMD, MIMD Structures, CISC Vs. RISC. Vector Pipeline Architectures and Pipelined CPU Architecture, Connectivity Interconnection Networks: Topology, Routing, Flow Control, Deadlock

Avoidance, Static and Dynamic Interconnection Networks, Concurrency and Synchronization, Parallel and Scalable Architectures. Case Study: Basic Features Current Architectural Trends .DSP Processor, Dual Core, Intel Core i3, i5, i7.

**References:** “Advanced Computer Architecture”, Kai Hwang, Tata McGraw Hill; “Computer Architecture & Organization”, John P. Hayes, Tata McGraw Hill; “Computer organization and Design; The hardware/Software interface”, John Hennessy & David Patterson, 2nd Edition, Morgan Kaufman Publishers; “Modern Operating Systems”, Andrew S Tanenbaum, 2nd Edition, Prentice Hall;

### **MCA – 523 SOFTWARE ENGINEERING**

Software Characteristics, Components, Models and Myths, Software Process and Metrics, Software Project Planning, Risk Management, Project Scheduling and Cost Estimation, Quality Assurance, System Engineering Concepts, Analysis, Modelling.

**References:** “Software Engineering”, Pressman, TMH; “Software Engineering”. Pankaj Jalote, Narosa Publication; “Software Engineering Concept”, Richard Fairley, TMH; “Analysis and design methods”, J. Senn, McGraw-Hill;

### **MCA-524 PRINCIPLES OF PROGRAMMING LANGUAGES**

Concepts & Elements of Programming Languages, Procedures and Processes; Iterative Vs. Recursive, Local Procedures and Local Variables, Programming Language Implementation – Compilation and Virtual Machines, Syntax and Semantics, Data Types, Concept Of Binding, Type Checking, Expressions and Statements, Control Subprograms and Blocks, Scope and Lifetime Of Variable, Overloaded Sub-Programs, Generic Sub-Programs, Co-Routines. Abstract Data Types, Concurrency Semaphores, Monitors, Message Passing, Threads. Exception Handling, Object Oriented Programming Logic Programming, Functional Programming Languages, Imperative Programming. Case Study: C, C++, C#, JAVA & Other Programming Languages.

**References:** “Concepts of Programming Languages” Robert .W. Sebesta, Pearson Education; “Programming Languages”, Louden, Thomson; “Programming Languages Design and Implementation”, Pratt & Zelkowitz, PHI/Pearson Education; “Concepts of Programming Languages” Robert Sebesta, Addison Wesley;

### **MCA–525 THEORY OF COMPUTATION**

Strings Alphabets and Language, Finite State Systems, Deterministic and Nondeterministic Finite Automata, Two Way Finite Automata, Finite Automata with Output, Finite State System, Regular Expression and Language, Regular Grammar. Properties of Regular Languages, Context Free Grammar & Language, Normal Forms, Pumping Lemma for CFL, Application for CFL Of Pumping Lemma. Closure Properties, Context Sensitive Language, Chomsky Hierarchy, Unrestricted Grammar, Pushdown Automata, Equivalence of PDA’s and CFL’s Turing Machine. Undecidability & Intractable Problems. Computational Complexity Theory. Case Study: LEX, YACC, JAVA CC.

**References:** “Introduction to Automata Theory Language and Computation”, By John E. Hopcraft & Jeffary D. Ullman; “Introduction to Automata Theory Language and Computation”,By John E. Hopcraft Jeffary D. Ullman & Rajeev Motwani; “Theory of Computer Science” K.L.P. Mishra & N. ChandraShekaran;

### **MCA-526 Programming Lab – II**

The students have to carry out the assignment work from papers MCA 521,MCA 524 & MCA 525.

## **THIRD SEMESTER**

### **MCA – 611 MATHEMATICS –III**

Probability Theory Conditional Probability, Baye’s Theorem. Non-Linear Regression, Multiple Correlations and Regression, Random Numbers: Algorithms for Generation of Random Numbers, Discrete Random Variables, Acceptance and Rejection Techniques. Random Variables and Distributions-Random Variables, Continuous Random Variables, Probability Density Functions. The Discrete Uniform, Distributions, Binomial, Poisson, Hyper Geometric Distributions. Continuous Probability Distributions, Uniform, Exponential and Normal Distributions. Hypothesis Testing-Testing of Statistical Hypothesis, Null Hypothesis, Tests of Hypothesis and Significance, One Failed Proportions, Chi-Square, T, Z and F Tests, Losses and Risks. Analysis of Variance- One Way and Two-Way. Matrix Decomposition, Singular Value Decomposition, PCA

**References:** “Mathematical Statistics”, J.E. Freund & R.E. Walpole; “Probability and Statistics with reliability queuing and Computer Science Applications” by K.S. Trivedi; “Introduction to Mathematical Statistics”, F. Kreyzic; “Statistical Analysis: Computer Oriented Approach” A.A. Affi;“Statistics” Schaum’s Series, M.R. Spiegel.” “Basic Principal Component Analysis”, I.T. Jouiffe Springer;

### **MCA-612 UNIX AND ITS INTERNALS**

General Overview of The System, Internal Representation of Files, Structures of Processes and Process Control, Process Scheduling, System Calls, Memory Management Policies, I/O Subsystem, The Inter-Process Communication.

**References:** “UNIX Utilities”, Tare, McGraw-Hill;“UNIX Operating System”, Subhajit Das;“Unix Operating System”, Maurice J Bach, Prentice-Hall; “Unix Shell Programming”, Yashavant P. Kanetkar, BPB Publications; “Unix” Stephen Prata;

### **MCA –613 WINDOWS PROGRAMMING AND SCRIPTING LANGUAGE**

Introduction to Windows Program. Message Processing, Menu and Accelerators. Handling Icons, Cursor and Bitmaps, Dialog Box & Child Window Controls, Working With Text and Font and Graphics, Consoles, Multitasking Process and Threads, Advance Window, Advance Features of Windows Programming Like GDI Metafiles, Clipboard Drag and Drops Sound API, Scripting Languages, Programming Through Vbscript, Java Scripts, Web Application Development Using Databases.

**References:** “Windows Programming”, Charles Petzold, Microsoft press; “Windows Programming”, Herbert Schildts, Osborne;

### **MCA – 614 ANALYSES AND DESIGN OF ALGORITHM**

Algorithm and its characteristics, Asymptotic Notations, Divide and Conquer Approach- Searching and Sorting, Matrix Operations, Recurrence Relations, Augmenting Data Structure, Dynamic Programming, Greedy Algorithm, Amortized Analysis, Branch & Bound Techniques, Linear Programming Problems, Tree and Graph- Minimum Spanning Tree, Shortest Path, NP hard and NP Complete Problems.

**References:** “Fundamentals of Computer Algorithms” Ellis Horowitz & Sartaj sehni galgotia; “Introduction to Algorithms”, Cormen, Leiserson, Rivets, PHI; “Algorithm Design”, Michael T. Goodrich & Roberto Tamassia; “Introduction to the Design & Analysis of Algorithms”, Anany Levitin, Addison Wesley; “Analysis and Design of Algorithm”, Ullman, TMH;

### **MCA – 615 DATA BASE MANAGEMENT SYSTEM**

Introduction to Database Design and Data Models, The Relational Model, Relational Algebra and Calculus, SQL, Embedded and Dynamic SQL, Query Processing and Optimization, Database Design Issues and Normalization, Transaction Processing and Concurrency Control, Failure and Recovery Systems, Security and Authorization, Design of Object Oriented Databases.

**References:** “Data Base Management System”, Raghu Ramakrishnan & Johannes Gehrke, McGraw-Hill; “Database System Concept”, Henry F. Korth Abraham Silber Schatz, McGraw-Hill; “Database System Concept”, C.J. Date, Addison Welsey; “SQL PL/SQL - The Programming Language of Oracle”, Ivan bayross, BPB Publications; “Fundamental of Database Systems”, Elmasi, R. & Navathe, Addison-Wesley.

### **MCA-616 Minor Project – I**

The students are require to develop small projects in Database, Window Programming etc.

## **FOURTH SEMESTER**

### **MCA – 621 COMPUTER ORIENTED OPTIMIZATION**

Linear Programming, Mathematical Model, Hungarian Method & Its Algorithm. Transportation Problem, Integer Programming Integer Programming Algorithm, Dynamic Programming Optimal Subdivision Problem, Decomposition, Queuing Theory , Queuing Problem and System, Transient and Steady State Distributions In , Queuing System, Poisson Process, Exponential Process, Classification of Queuing Models, Inventory Theory Economic Deterministic Inventory Models Probabilistic Inventory Models With Instantaneous Demand , Games Theory Minimax-Maxmin



Principle for Mixed Strategy Games, , Graphical Method, Solution of (Mxn) Job Sequencing PERT – CPM.

**References:** “Operations Research”, S.D. Sharma, Kedarnath Ramnath & Co.; “Operations Research”, P.K.Gupta & D.S.Hira, S.Chand & Co; “Operations Research”, Kantiswaroop, S.Chand & Sons; “Introduction to Operations Research A Computer-Oriented Algorithmic Approach”, Billy E. Gillett, TMH; “Introduction to operations Research”, Hillier, TMH;

### **MCA – 622 COMPUTER NETWORKS**

Introduction: Type of Networks & Protocol Hierarchies. Reference Models: The OSI & TCP/IP Reference Models, Physical Layer: Transmission Media & Related Issues; Analog, Digital & Wireless Transmission, Transmission and Switching, The Data Link Layer: Design Issues: Services Provided, Framing, Error Control, Flow Control; Error Detection and Correction; Elementary and Sliding Window Protocols, Medium Access Sub Layer, Channel Allocation Problem, Multiple Access Protocols, Ethernet, IEEE 802 Standards for Lans And Mans, Network Layer, Design Issues, Routing Algorithms, Congestion Control, QOS, Internetworking, IP & IP Addressing, Transport Layer : Transport Service, Elements Of Transport Protocols, TCP & UDP, Application Layer Overview : Email, DNS, WWW. Case Study: Network Monitoring & Simulation: Study Of Wireshark, NS-2,NS-3, Exata Etc.

**References:** “Computer networks”, Andrew S. Tanenbaum, Prentice Hall; “Communication networks: fundamental concepts and key architectures”, Leon Garcia, TMH; “Local Area Networks”, Gred Keiser, TMH; “Beginning Programming with C++ For Dummies”, Stephen R. Davis, John Wiley & Sons; “Unix Network Programming”, S. Davis, PHI; Kurose, “Computer Networking : A Top-Down Approach Featuring the Internet”, J.F. Kurose & K.W. Ross, Addison Wesley;

### **MCA-623 COMPILER DESIGN**

Introduction to Compiling, Lexical Analysis, Parsing Techniques, Syntax Directed Translation, Symantec Analysis, Symbol Table, Code Generation & Code Optimization Techniques,

**References:** “Art of Compiler Design : The Theory & Practice”, Thomas Pittman & James F. Peters, Prentice Hall; “Compiler Design” Renhord Wilhelum & Dieter Mauerl; “Compiler design in C”, Allen I. Holub, Prentice Hall; “Building an optimizing compiler”, Robert Morga & Butterworth-Heinemann; Modern Compiler Design;

### **MCA-624 DISTRIBUTED SYSTEMS**

Distributed System & Its Architecture. Hardware & Software Issues. Communication: Layered Protocols, Client Server Protocols, RPC, Group Communication. Coordination, Synchronization & Consistency: Logical Clocks, Physical Clocks, Mutual Exclusion, Election Algorithms, Atomic Broadcast, Sequential Consistency Transaction Distributed Consensus, Threads: Thread Synchronization, Implementation Issues, Threads Vs. RPC, Models of Distributed Computing: Client Server and RPC, RPC Architecture & Underlying Protocols, IDL, Marshalling. Group

Models and Peer To Peer: Groups For Service Replication/Reliability, Groups for Parallelism / Performance, Client/ Server Vs. Peer-To-Peer, Multicast, Atomic Broadcast, Distributed File System, Distributed Shared Memory & Its Architecture, Fault Tolerant Distributed Systems, Distributed Multimedia System, Security Techniques and Cryptography.

**References:** “Distributed Systems”, Concepts and Design”, George Colouris, Dick Grune Henri E.bal Cerial .h.jacobs Koen G.la, Pearson Education India; Distributed System, Sape Mull Ender, Addison Wesley;

### **MCA-625 WEB BASED APPLICATIONS DEVELOPMENT**

Programming with JAVA, Packages, JDBC & ODBC Connectivity, Types of Drivers, Remote Method Invocation RMI, JAVA BEANS, JAVA Security, Concepts of COM, DCOM, Active X, ORB, WAP, Bluetooth, Net Technology, Case Study: Perl, Python, PHP.

**References:** “Complete Reference JAVA2”, H.Schildt, TMH; “Java Servlets”, Phil Hanna, TMH; “Java Thread Programming”, Paul Hyde, Sams; “Java Virtual Machine”, Tim Lindholm & Frank Yellin, Addison Wesley;

### **MCA-626 Minor Project – II**

The students are required to develop Web Based Applications.

## **FIFTH SEMESTER**

### **MCA – 711 COMPUTER GRAPHICS**

Graphics System and Primitives, Input and Output Devices, Shapes & Drawing Algorithms, Scan Conversion, Geometric Transformation, Viewing & Clipping, Curves, Lines and Surfaces, Colour & Shading Models, Projection, Hidden Surfaces, Introduction to Multimedia and Animation. Case Study: Graphics Tool Kit.

**References:** “Computer Graphics”, D.Hearn & M.P. Baker, Pearson Education; “Procedural Elements of Computer Graphics”, David F. Rogers, WCB/McGraw-Hill; “Principles of interactive computer graphics”, New Mann & Sprovl, McGraw-Hill; “Digital Multimedia” Nigel Chapman & J. Chapman, Wiley India;

### **MCA-712 INTELLIGENT SYSTEMS**

Introduction to Intelligent System, Heuristic Search Techniques, Knowledge Representation using Predicate Logic, Semantic Nets, Frames, Conceptual Dependency.

Natural language Processing and Study of its Different Phases, Game Playing, Planning: Nonlinear and Hierarchical planning. Statistical Reasoning: Probability and Bayes Theorem Certainty Factor and Rule Based System Parallel and Distributed AI Psychological Modeling, Learning, Expert System, Common Sense, Ontology.

**References:** “Artificial Intelligence”: Kevin Knight, Elaine Rich & B. Nair, McGraw Hill Education; “Artificial Intelligence: A Modern Approach”, Stuart Russell & Peter Norvig, Prentice-Hall;

### **MCA-713 MOBILE APPLICATION DEVELOPMENT**

Introduction to Mobile Computing, Factors in Developing Mobile Applications, Mobile Software Engineering Frameworks and Tools, Mobile Application Design :Application Model and Infrastructure, Hardware and Software Architecture Mobile development Environment and Software, Interface Development for Mobile Apps, Intents and Services, Storing and Retrieving Data, Mobility and Location Based Services ,Communications, Web Telephony, Notifications and Alarms, Graphics, Multimedia, Packaging and Deploying, Security and Hacking.

Case Study: Android, Symbian /S60, Mac, BREW, JavaME/JavaFX etc.

**References:** “Mobile Design and Development”, Brian Fling, O'Reilly Media; “Mobile Applications Development”, Scott B. Guthery, Mary J. Cronin, McGraw-Hill; “Professional Android Application Development”, Reto Meier, Wrox;

## **ELECTIVE-I**

### **MCA-731 DATA WAREHOUSING & MINING**

Data Warehousing & Mining, Data Pre-processing, Mining Association Rules, Classification and Prediction, Classifier Accuracy, Cluster Analysis, Applications and trends in Data Mining, Graph Mining, Text Mining, Case Study: Data Mining Tools.

**References:** “Building Data Ware House”, W.H.Inmon, John Wiley & Sons; “Data Mining Concepts & Techniques”, Jiawei Han & Micheline Kamber; Harcourt India PVT Ltd; “Oracle 8i Building Data Ware Housing” Michall Corey, M.Abbey, I Azramson & Ben Taub, TMH; “Data Mining, Practical Machine Learning tools & techniques with Java” Ian H. Witten & Eibe Frank, Morgan Kanffmen;

### **MCA-732 ADVANCED SOFTWARE ENGINEERING**

Design Concepts and Principles of Software Design and Engineering, Software Testing Methods and Strategies, Object-Oriented Software Engineering, Object-Oriented Testing, Software Quality Assurance, Web Engineering Client-Server Software Engineering, Reengineering, Computer-AIDED Software Engineering. Case Study: Rational Rose & Other Case Tools.

**References:** “Software Engineering- A Practitioner’s Approach”, R. S. Pressman, McGraw Hill; “Software Engineering”, Ian Sommerville, PHI; “An integrated approach to software engineering”, Pankaj Jalote, Narosa; “Fundamentals of Software Engineering”, A. Leon & M. Leon, Vikas;

### **MCA-733 ADVANCED RDBMS**

The Extended Entity Relationship Model and Object Model, Object-Oriented Databases, Complex Objects, and Database Schema Design for OODBMS,

OODBMS Architecture and Storage issues. Object Relational and Extended Relational Databases Query Processing and Optimization, Advance Querying. Parallel and Distributed Databases and Client-Server Architecture and various issues i.e. Data Fragmentation, Replication, and Allocation Techniques for Distributed and Parallel Database. Databases on the Web and Semi Structured Data: Web Data and XML, Temporal Database Concepts, Spatial Databases, Mobile Databases, Geographic Information Systems, Multimedia Databases. Advance Transaction Processing Systems and Multimedia Database. Case Studies: Advance Features in Oracle, Microsoft SQL Server for Multimedia Database, Web Database.

**References:** “Fundamentals of Database Systems”, Elmasri and Navathe, Pearson Education; “Database System Concepts”, Korth, Silberchatz & Sudarshan, McGraw-Hill;” Introduction to Database Systems”, C.J.Date & Longman, Pearson Education;

### **MCA-734 INFORMATION RETRIEVAL**

Goals and History of IR, Basic IR Models, Experimental Evaluation of IR, IR Forums, Query Languages and Operations, Text and Text Operations, Indexing and Searching, Web Search Engines: Spiderling Met Crawlers.

Multimedia Languages and Properties & IR: Models & Languages, Parallel and Distributed IR, User Interface and Visualization, Digital Libraries, Recommender Systems, Information Extraction and Integration

**References:** “Modern Information Retrieval”, Ricardo Baeze & Yates Berthier Ribeiro-Neto, Pearson Publication; “Introduction to Information by Manning”, Raghavan & Schuetze, Retrieval Cambridge University Press;

### **MCA-735 NATURAL LANGUAGE PROCESSING**

Introduction to Natural Language Processing: Linguistic Background, Grammar and Parsing: Grammars & Parsing, Ambiguity Resolution. Semantic & Logic Forms, Linking Syntax and Semantics, Ambiguity Resolution, Symantec Interpretation, Knowledge Interpretation Reasoning. Local Discourse Context and References Discourse Structure, Conversational Structure.

**References:** “Natural Language Understanding”, James Allen, Pearson Education; “Foundations of Statistical Natural Language Processing” Christopher D. Manning & Hinrich Schuetze, MIT Press; “Statistical Machine Translation” Philipp Koehn, University of Edinburgh Cambridge Press;

## **ELECTIVE – II**

### **MCA-741 MULTIMEDIA COMPUTING**

Introduction to Multimedia, Multimedia Objects, Multimedia Hardware, Software, Presentation Tools, Audio & Video File Formats, Sampling, Digital Audio Concepts, Compression, Multiple Monitors, Bitmaps, Video Representation, MHEG Standard, Recent Development in Multimedia.

**References:** “Multimedia, Making IT Work”, Tay Vaughan, Osborne McGraw Hill; “Multimedia Systems”, Buford, Addison Wesley; “Multimedia technology and Applications”, David Hillman, Galgotia Publications; “Data Compression Book”, Mark Nelson, BPB;

### **MCA-742 PARALLEL COMPUTING**

Computational Demands, Advantages of Parallel Systems, Topologies, PARAM Model of Parallel Computation, PARAM Algorithms, Mapping and Scheduling, Applications of Parallel Computing.

**References:** “Parallel Computing: Theory and Practice”, Michael Jay Quinn, McGraw-Hill; “Advanced Computer Architecture”, Kai Hwang & Naresh Jotwani, McGraw-Hill;

### **MCA-743 CLOUD COMPUTING**

Introduction to Cloud Computing, Cloud Architecture and Service Models, The Economics and Benefits of Cloud Computing, Horizontal/Vertical Scaling, Thin Client, Multimedia Content Distribution, Multiprocessor and Virtualization, Distributed Storage, Security and Federation/ Presence/ Identity/ Privacy in Cloud Computing, Disaster Recovery, Free Cloud Services and Open Source Software and Example Commercial Cloud Services.

**References:** “Cloud Computing Implementation Management and Security”, J W Rittinghouse & J F Ransome, CRC Press; “Cloud Application Architecture”, George Reese, O’Reilly;

### **MCA-744 IMAGE PROCESSING**

Introduction to Image Processing Systems, Digital Image Fundamentals, Manipulation on Images, Images Transformation, Image Smoothing, Restoration, Image Encoding and Segmentation, Edge linking and boundary detection, Thresholding, Filtering, Information Theory. Image Representation Models.

**References:** “Digital Image Processing”, Rafael C. Gonzalez, Richard E. Woods, PHI; “Digital Image Processing, A.K.Jain, PHI; “Computer Image Processing and Recognition”, Hall, E. L., Research sponsored by the U.S. Air Force; “Digital Image Processing”, Pratt, W. K, Wiley-Interscience, New York.; “Digital Image Processing”, Bernd Jahne, Springer;

### **MCA-745 NEURAL N/W & FUZZY LOGIC**

Introduction to Neural Network Architecture and Basic Models of Neural Network: Mculloh Pit Model, Hopfield Network, Adaline and Madaline, Supervised and Unsupervised learning Learning. Supervised Neural Network, Perceptron, Convergence theorem, Multi-layer Perceptrons, Attractor Neural Network: Bidirectional Associative Memory. Radial Basis Function Networks, Kernel methods for pattern analysis: Support Vector Machines, Support Vector Regression. Self-Organizing Maps, Feedback Neural Network, Adaptive Resonance Theory. Basic Concepts of Fuzzy Logic. Case Study: MATLAB Tool Boxes.

**References:** “Neural Network”, Simon Haykin, Pearson Education Association; Satish Kumar, “Neural Networks – A Classroom Approach”, Satish Kumar, Tata McGraw-Hill;

**MCA-714 MINOR PROJECT III**

The students are required to develop a small project in any concern area of the study as decided by supervisors.

**SIXTH SEMESTER**

The student is required to work on a major project during this semester.

**MCA-721 FINAL DISSERTATION (MAJOR PROJECT)**

**MCA-722 SEMINAR/PRESENTATION (MAJOR PROJECT)**