MASTERS OF SCIENCE (COMPUTER SCIENCE) M. Sc(C.S)

Year	Semester	Course Code	Course Title	L	T	P	C
1	1	MCA-111	Professional Communication	2	1	0	3
		MMTH-112	Discrete Mathematics	2	1	0	3
		MCA-112	Computer Fundamentals And C Programming	2	1	2	4
		MCA-113	Database Management System	2	1	2	4
		MCA-114-(1,2,3)	Elective-I	3	1	0	4
			Total	**11**	**5**	**4**	**18**
	2	MCA-121	Digital Logic Design	3	1	0	4
		MCA-122	Data Structures Using 'C'	2	1	2	4
		MCA-123	Object Oriented Systems & C++	2	1	2	4
		MCA-124	Operating Systems	3	1	0	4
		MCA-125-(1,2,3)	Elective-II	3	1	0	4
			Total	**13**	**5**	**4**	**20**
2	1	MCA-211	Computer Networks	3	1	0	4
		MCA-212	Design & Analysis Of Algorithms	2	1	2	4
		MCA-213	Software Engineering	3	1	0	4
		MCA-214	Internet & Java Programming	2	1	2	4
		MCA-215-(1,2,3)	Elective-III	3	1	0	4
			Total	**13**	**5**	**4**	**20**
	2	MCA-221	Project Work	-	-	40	20
		MCA-222	Comprehensive VIVA	-	-	4	2
			Total	**-**	**-**	**44**	**22**

LIST OF ELECTIVE SUBJECTS:

LIST OF DEPARTMENTAL ELECTIVES

MCA-114
- ❖ Accounting And Financial Management
- ❖ Environmental Science And Ethics
- ❖ Operation Research

MCA-125

- ❖ Artificial Intelligence
- ❖ E-Commerce
- ❖ Image Processing

MCA-215
- ❖ Advanced Database Management Systems
- ❖ Information Storage &Management
- ❖ Cloud Computing

MCA-111 PROFESSIONAL COMMUNICATION

L	T	P	Cr
2	1	0	3

RATIONALE

Professional communication encompasses the students about written, oral, visual and digital communication within a workplace context. This discipline blends together pedagogical principles of rhetoric, technology, software, and learning theory to improve and deliver communication in a variety of settings ranging from technical writing to usability and digital media design.

UNITS	CONTENTS	Contact Hrs.
I	**Basics of Technical Communication** Technical Communication: features; Distinction between General and Technical communication; Language as a tool of communication; Levels of communication: Interpersonal, Organizational, Mass communication; The flow of Communication: Downward, Upward, Lateral or Horizontal (Peer group); Importance of technical communication; Barriers to Communication.	7
II	**Constituents of Technical Written Communication** Words and Phrases: Word formation. Synonyms and Antonyms; Homophones; Select vocabulary of about 500-1000 New words; Requisites of Sentence Construction: Paragraph Development: Techniques and Methods -Inductive, Deductive, Spatial, Linear, Chronological etc; The Art of Condensation- various steps.	8
III	**Forms of Technical Communication** Business Letters: Sales and Credit letters; Letter of Enquiry; Letter of Quotation, Order, Claim and Adjustment Letters; Job application and Resumes. Official Letters: D.O. Letters; Govt. Letters, Letters to Authorities etc. Reports: Types; Significance; Structure, Style & Writing of Reports. Technical Proposal; Parts; Types; Writing of Proposal; Significance. Technical Paper, Project. Dissertation and Thesis Writing: Features, Methods & Writing.	9
IV	**Presentation Strategies** Defining Purpose; Audience & Locale; Organizing Contents; Preparing Outline; Audio-visual Aids; Nuances of Delivery; Body Language; Space; Setting Nuances of Voice Dynamics; Time- Dimension.	7
V	**Value- Based Text Readings** Following essays form the suggested text book with emphasis on Mechanics of writing, i. The Aims of Science and the Humanities by M.E. Prior ii. The Language of Literature and Science by A.Huxley iii. Man and Nature by J.Bronowski iv. The Mother of the Sciences by A.J.Bahm v. Science and Survival by Barry Commoner vi. Humanistic and Scientific Approaches to Human Activity by Moody E. Prior vii. The Effect of Scientific Temper on Man by Bertrand Russell	9

REFERENCE BOOKS		
1.	Improve Your Writing Chandra	V.N. Arora and Laxmi Chandra,
2.	Technical Communication – Principles and Practices	Meenakshi Raman & Sangeeta Sharma,
3.	Effective Technical Communication	Barun K. Mitra, Oxford Univ. Press, 2006
4.	Business Correspondence and Report Writing	Prof. R.C. Sharma & Krishna Mohan,
5.	Manual of Practical Communication;	L.U.B. Pandey & R.P. Singh A.I.T.B.S..

MMTH-112 DISCRETE MATHEMATICS

L	T	P	Cr
2	1	0	3

RATIONALE
Discrete mathematics is mathematics that deals with discrete objects. In this course we will be concerned with objects such as integers, propositions, sets, relations and functions, which are all discrete.

UNITS	CONTENTS	Contact Hrs.
I	Set Theory: Introduction, Size of sets and cardinals, Venn diagrams, Combination of sets, Multisets, Ordered pairs and Set identities. Relations & Functions: Relations - Definition, Operations on relations, Composite relations, Properties of relations, Equality of relations, Partial order relation. Functions - Definition, Classification of functions, Operations on functions, Recursively defined functions. Notion of Proof: Introduction, Mathematical Induction, Strong Induction and Induction with Nonzero base cases.	7
II	**Lattices:** Introduction, Partial order sets, Combination of partial order sets, Hasse diagram, Introduction of lattices, Properties of lattices – Bounded, Complemented, Modular and Complete lattice.	5
III	Boolean Algebra: Introduction, Axioms and Theorems of Boolean algebra, Boolean functions. Simplification of Boolean Functions, Karnaugh maps, Logic gates, Digital circuits and Boolean algebra.	6
IV	Propositional & Predicate Logic: Propositions, Truth tables, Tautology, Contradiction, Algebra of propositions, Theory of Inference and Natural Deduction. Theory of predicates, First order predicate, Predicate formulas, quantifiers, Inference theory of predicate logic	6
V	Recurrence Relations: Introduction, Growth of functions, Recurrences from algorithms, Methods of solving recurrences. Combinatorics: Introduction, Counting Techniques, Pigeonhole Principle, Pólya's Counting Theory.	6

REFERENCE BOOKS :		
1.	Discrete Mathematics and Its Applications	Kenneth H. Rosen
2.	Discrete Mathematics	Norman L.Biggs
3.	Discrete Mathematics By	Katson Publications

MCA-112 COMPUTER FUNDAMENTALS AND C PROGRAMMING

L	T	P	CR
2	1	2	4

RATIONALE
This fundamental course will enable the students to learn the concepts of Computers and Programming Language and design principles along with understanding of C Language. And the fundamental computers so they can ave the deep knowledge of computer.

UNITS	CONTENTS	Contact Hrs.
I	Introduction to any Operating System [Unix, Linux, Windows], Programming Environment, Write and Execute the first program, Introduction to the Digital Computer; Concept of an algorithm; termination and correctness. Algorithms to programs: specification, top-down development and stepwise refinement. Introduction to Programming, Use of high level programming language for the systematic development of programs. Introduction to the design and implementation of correct, efficient and maintainable programs, Structured Programming, Trace an algorithm to depict the logic, Number Systems and conversion methods	5
II	Standard I/O in "C", **Fundamental Data Types and Storage Classes:** Character types, Integer, short, long, unsigned, single and double-precision floating point, storage classes, automatic, register, static and external, **Operators and Expressions:** Using numeric and relational operators, mixed operands and type conversion, Logical operators, Bit operations, Operator precedence and associatively.	4
III	**Conditional Program Execution:** Applying if and switch statements, nesting if and else, restrictions on switch values, use of break and default with switch, **Program Loops and Iteration:** Uses of while, do and for loops, multiple loop variables, assignment operators, using break and continue, **Modular Programming:** Passing arguments by value, scope rules and global variables, separate compilation, and linkage, building your own modules.	6
IV	**Arrays:** Array notation and representation, manipulating array elements, using multidimensional arrays, arrays of unknown or varying size, **Structures:** Purpose and usage of structures, declaring structures, assigning of structures, **Pointers to Objects:** Pointer and address arithmetic, pointer operations and declarations, using pointers as function arguments, Dynamic memory allocation, defining and using stacks and linked lists	6
V	Sequential search, Sorting arrays, Strings, Text files, **The Standard C Preprocessor:** Defining and calling macros, utilizing conditional compilation, passing values to the compiler, **The Standard C Library:** Input/Output : fopen, fread, etc, string handling functions, Math functions : log, sin, alike Other Standard C functions.	4

PRACTICALS	
1	Write C program to find largest of three integers.
2	Write C program to check whether the given string is palindrome or not.
3	Write C program to find whether the given integer is (i) A prime number (ii) An Armstrong number.
4	Write C program for Pascal triangle.
5	Write C program to find sum and average of n integer using linear array.

6	Write C program to perform addition, multiplication, transpose on matrices.	
7	Write C program to perform following operations by using user defined functions: (i) Concatenation (ii) Reverse (iii) String Matching	
8	Write C program to interchange two values using (i) Call by value. (ii) Call by reference.	
9	Write C program to display the mark sheet of a student using structure.	
10	Write C program to perform following operations on data files: (i) read from data file. (ii) write to data file.	
2.	Let us 'C'	Yashwant kantekar
3	Problem Solving and Program Design in C	Jeri R. Hanly, Elliot B. Koffman Pearson Addison-
4	Computer fundamentals	P.K sinha

MCA-113 DATABASE MANAGEMENT SYSTEM

L	T	P	C
2	1	2	4

	RATIONALE	
5	Creating Forms, Reports etc.	
6	Writing codes for generating read and update operator in a transaction using different situations.	
7	Implement of 2PL concerning central algorithm	
8	Developing code for understanding of distributed transaction processing. Students are advised to use Developer 2000 Oracle 8+ version for above experiments. However, depending on the availability of Software's students may use power builder / SQL Server / DB2 etc. for implementation.	
I	**Introduction:** An overview of database management system, Database System Vs File System, Database system concepts and architecture, data models schema and instances, data independence and data base language and interfaces, Data definitions language, DML, Overall Database Structure. **Data Modeling using the Entity Relationship Model:** ER model concepts, notation for ER diagram, mapping constraints, keys, Concepts of Super Key, candidate key, primary key, Generalization, aggregation, reduction of an ER diagrams to tables, extended ER model, relationships of higher degree.	6
II	**Relational data Model and Language:** Relational data model concepts, integrity constraints: entity integrity, referential integrity, Keys constraints, Domain constraints, relational algebra, relational calculus, tuple and domain calculus. **Introduction to SQL:** Characteristics of SQL, Advantages of SQL, SQL data types and literals, Types of SQL commands, SQL operators and their procedure, Tables, views and indexes, Queries and sub queries, Aggregate functions, Insert, update and delete operations, Joins, Unions, Intersection, Minus, Cursors in SQL. PL/SQL, Triggers and clusters.	6
III	**Data Base Design & Normalization:** Functional dependencies, normal forms, first, second, third normal forms, BCNF, inclusion dependencies, loss less join decompositions, normalization using FD, MVD, and JDs, alternative approaches to database design	4
IV	**Transaction Processing Concepts:** Transaction system, Testing of serializability, Serializability of schedules, conflict & view serializable schedule, recoverability, Recovery from transaction failures, log based recovery, checkpoints, deadlock handling.	4
V	**Concurrency Control Techniques:** Concurrency control, locking Techniques for concurrency control, Time stamping protocols for concurrency control, validation based protocol, multiple granularity, Multi-version schemes, Recovery with concurrent transaction. Transaction Processing in Distributed system, data fragmentation. Replication and allocation techniques for distributed system, overview of concurrency control and recovery in distrusted database	5

	PRACTICALS
1	Create Table, SQL for Insertion, Deletion, Update and Retrival using aggregating functions.
2	Write Programs in PL/SQL, Understanding the concept of Cursors.
3	Write Program for Join, Union & intersection etc.
4	Creating Views, Writing Assertions, Triggers.

	REFERENCE BOOKS :	
1.	"An Introduction To Database System"	Date C J, Addision Wesley
2.	"Database Concepts"	Korth, Silbertz, Sudarshan, McGraw Hill
3.	"Fundamentals Of Database Systems"	Elmasri, Navathe, Addision Wesley
4.	"Database Systems"	Beynon Davies, Palgrave Macmillan
5.	"Database Management System"	Majumdar & Bhattacharya, TMH

MCA-114 ACCOUNTING AND FINANCIAL MANAGEMENT

L	T	P	CR
3	1	0	4

RATIONALE
Financial accounting (or financial accountancy) is the field of accounting concerned with the summary, analysis and reporting of financial transactions pertaining to a business.

UNITS	CONTENTS	Contact Hrs.
I	***Overview***: Accounting concepts, conventions and principles; Accounting Equation, International Accounting principles and standards; Matching of Indian Accounting Standards with International Accounting Standards.	8
II	***Mechanics of Accounting***: Double entry system of accounting, journalizing of transactions; preparation of final accounts, Profit & Loss Account, Profit & Loss Appropriation account and Balance Sheet, Policies related with depreciation, inventory and intangible assets like copyright, trademark, patents and goodwill	8
III	***Funds Flow Statement***: Meaning, Concept of Gross and Net Working Capital, Preparation of Schedule of Changes in Working Capital, Preparation of Funds Flow Statement and its analysis	7

IV	Conversion of regular expression to Finite Automata, NFA, DFA, Conversion of NFA to DFA, Optimizing DFA, FA with output: Moore machine, Mealy machine, Conversions	9
V	**Cash Flow Statement:** Various cash and non-cash transactions, flow of cash, preparation of Cash Flow Statement and its analysis	8

REFERENCE BOOKS :		
1.	Financial Accounting : A Managerial Perspective	Narayanswami(PHI, 2nd Edition).
2.	Financial Accounting for Management	Mukherjee(TMH, 1st Edition).
3.	Financial Accounting for Management	Ramchandran & Kakani(TMH, 2nd Edition).
4.	Accounting and Finance for Managers	Ghosh T P(Taxman, 1st Edition).
5.	An Introduction to Accountancy	Maheshwari S.N & Maheshwari S K

MCA-114 ENVIRONMENTAL SCIENCE AND ETHICS

L	T	P	CR
3	1	0	4

RATIONALE
Environmental ethics is the part of environmental philosophy which considers extending the traditional boundaries of ethics from solely including humans to including the non-human world. It exerts influence on a large range of disciplines including environmental law, environmental sociology, Eco theology, ecological economics, ecology and environmental geography.

UNITS	CONTENTS	Contact Hrs.
I	THE MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES Definition, Scope and Importance, Need for Public Awareness. NATURAL RESOURCES # Renewable and Non-renewable Resources: NATURAL RESOURCES AND ASSOCIATED PROBLEMS: - • FOREST RESOURCES: use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people. • WATER RESOURCES: use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. • MINERAL RESOURCES: use and exploitation, environmental effects of extracting and using mineral resources, case studies. • FOOD RESOURCES: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. • ENERGY RESOURCES: Growing energy needs, renewable & nonrenewable energy sources, use of alternate energy sources, case studies • LAND RESOURCES: Land as a resource, land degradation, man induced landslides,	9

| | soil erosion and desertification.
Role of an individual in conservation of natural resources.
Equitable use of resources for sustainable lifestyles | |

II	**ECOSYSTEMS** # Concept of an ecosystem # Structure and function of an ecosystem # Producers, consumers and decomposers # Energy flow in the ecosystem # Ecological succession # Food chains, food webs and ecological pyramids # Introduction, types, characteristic features, structure and function of the following ecosystem: - • Forest ecosystem • Grassland ecosystem • Desert ecosystem • Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) **BIODIVERSITY AND ITS CONSERVATION** # Introduction – Definition: genetic, species and ecosystem diversity. # Biogeographical classification of India # Value of biodiversity: Consumptive use, productive use, social, ethical & aesthetic & option values. # Biodiversity at global, National and local levels. # India as a mega-diversity nation # Hot-sports of biodiversity. # Threats to biodiversity: Habitat loss, poaching of wildlife, man-wildlife conflicts. # Endangered and endemic species of India # Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.	**7**
III	**ENVIRONMENTAL POLLUTION** <u>DEFINITION</u>: # Causes, effects and control measures of: - • Air pollution • Water pollution • Soil pollution • Marine pollution • Noise pollution • Thermal pollution • Nuclear pollution # Solid waste Management: Causes, effects and control measures of urban and industrial wastes. # Role of an individual in prevention of pollution # Pollution case studies # Disaster Management: Floods, earthquake, cyclone and landslides.	**7**
IV	**SOCIAL ISSUES AND THE ENVIRONMENT** # From Unsustainable to Sustainable development # Urban problems related to energy. # Water conservation, rain water harvesting, watershed management # Resettlement and rehabilitation of people; its problems and concerns. Case Studies # Environmental Ethics: Issues and possible solutions. # Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents & holocaust. Case Studies. # Wasteland reclamation. # Consumerism and waste products # Environment Protection Act. # Air (Prevention and Control of Pollution) Act	**8**

	# Water (Prevention and Control of Pollution) Act # Wildlife Protection Act # Forest Conservation Act # Issues involved in enforcement of environmental legislation # Public awareness	
V	HUMAN POPULATION AND THE ENVIRONMENT # Population growth, variation among nations. # Population explosion: Family Welfare Programme. # Environment and human health # Human Rights # Value Education # Women and Child Welfare # Role of Information Technology in Environment and human health	8

REFERENCE BOOKS :		
1.	Environmental Science	Miller T.G
2.	Introduction to Environmental Engineering and Science	by Gilbert M.Masters
3.	The Biodiversity of India	by Bharucha Erach
4.	Essentials of Ecology	by Townsend C., Harper J and Michael Begon

MCA-114 OPERATION RESEARCH

L	T	P	CR
3	1	0	4

UNITS	CONTENTS	Contact Hrs
I	**Linear Programming**: Simplex Method Revised simplex method, Duality in Linear programming, Application of Linear Programming to Economic and Industrial Problems.	9
II	**Function:** Types, Composition of function, Recursively defined function	7
III	Introduction to defining language, Kleene Closure, Arithmetic expressions, Chomsky Hierarchy, Regular expressions, Generalized Transition graph.	8
IV	**Mathematical Induction:** Piano's axioms, Mathematical Induction, Discrete Numeric Functions and Generating functions. Simple Recurrence relation with constant coefficients, Linear recurrence relation without constant coefficients, Asymptotic Behavior of functions	8
V	**Algebraic Structures:** Properties, Semi group, Monoid, Group, Abelian group, properties of group, Subgroup, Cyclic group, Cosets, Permutation groups, Homomorphism, Isomorphism and Automorphism of groups.	8

REFERENCE BOOKS :		
1.	Operations Research	Taha, Macmillan.
2.	Introduction to Operations Research	B.E. Gillet, McGraw-Hill.
3.	Optimization Theory and Applications	S.S.Rao,Wiley Eastern.
4.	Linear programming	G.Hadley,Addison-Wesley.
5.	Operations Research	K. Swarup, P.K. Gupta & M. Mohan

MCA-121 DIGITAL LOGIC DESIGN

L	T	P	C
3	1	0	4

RATIONALE
Understanding of principle, operation and analysis of digital electronics.

UNITS	CONTENTS	Contact Hrs
I	Digital system and binary numbers: : Signed binary numbers, binary codes, cyclic codes, error detecting and correcting codes, hamming codes, Floating point representation Gate-level minimization: The map method up to five variable, don't care conditions, POS Simplification, NAND and NOR implementation, Quine McClusky method (Tabular method).	9
II	Combinational Logic: Combinational circuits, analysis procedure, design procedure, binary adder,subtractor, decimal adder, binary multiplier, magnitude comparator, decoders, encoders, multiplexers	7
III	Synchronous Sequential logic: Sequential circuits, storage elements: latches, flip flops, analysis of clocked sequential circuits, state reduction and assignments, design procedure,Registers and counters: Shift registers, ripple counter, synchronous counter, other counters.	9
IV	Memory and programmable logic: RAM, ROM, PLA, PAL,Design at the register transfer level: ASMs, design example, design with multiplexers	7
V	Asynchronous sequential logic: Analysis procedure, circuit with latches, design procedure, reduction of state and flow table, race free state assignment, hazards.	8

REFERENCE BOOKS :		
1.	DigitalDesign", Education	M. Morris Mano and M. D. Ciletti
2.	Switching Circuit & Logic Design	Hill & Peterson,Wiley.

MCA-122 DATA STRUCTURES USING 'C'

L	T	P	CR
2	1	2	4

RATIONALE
Data structures are the techniques of designing the basic algorithms for real-life projects. Understanding of data structures is essential and this facilitates the understanding of the language. The practice and assimilation of data structure techniques is essential for programming. The knowledge of 'C' language and data structures will be reinforced by practical exercises during the course of study. The course will help students to develop the capability of selecting a particular data structure.

UNITS	CONTENTS	Contact Hrs
I	**Introduction:** Basic Terminology, Elementary Data Organization, Data Structure operations, Algorithm Complexity and Time-Space trade-off **Arrays**: Array Definition, Representation and Analysis, Single and Multidimensional Arrays, address calculation, application of arrays, Character String in C, Character string operation, Array as Parameters, Ordered List, Sparse Matrices, and Vectors. **Stacks:** Array Representation and Implementation of stack, Operations on Stacks: Push & Pop, Array Representation of Stack, Linked Representation of Stack, Operations Associated with Stacks, Application of stack: Conversion of Infix to Prefix and Postfix Expressions, Evaluation of postfix expression using stack. **Recursion:** Recursive definition and processes, recursion in C, example of recursion, Tower of Hanoi Problem, simulating recursion. Backtracking, recursive algorithms, principles of recursion, tail recursion, removal of recursion.	12
II	**Queues:** Array and linked representation and implementation of queues, Operations on Queue: Create, Add, Delete, Full and Empty. Circular queue, Deque, and Priority Queue. **Linked list**: Representation and Implementation of Singly Linked Lists, Two-way Header List, Traversing and Searching of Linked List, Overflow and Underflow, Insertion and deletion to/from Linked Lists, Insertion and deletion Algorithms, Doubly linked list, Linked List in Array, Polynomial representation and addition, Generalized linked list, Garbage Collection and Compaction.	8
III	**Trees**: Basic terminology, Binary Trees, Binary tree representation, algebraic Expressions, Complete Binary Tree. Extended Binary Trees, Array and Linked Representation of Binary trees, Traversing Binary trees, Threaded Binary trees. Traversing Threaded Binary trees, Huffman algorithm. **Searching and Hashing**: Sequential search, binary search, comparison and analysis, Hash Table, Hash Functions, Collision Resolution Strategies, Hash Table Implementation. 15	8
IV	**Sorting**: Insertion Sort, Bubble Sorting, Quick Sort, Two Way Merge Sort, Heap Sort, Sorting on Different Keys, Practical consideration for Internal Sorting. **Binary Search Trees**: Binary Search Tree (BST), Insertion and Deletion in BST, Complexity of Search Algorithm, Path Length, AVL Trees, B-trees.	6
V	**Graphs:** Terminology & Representations, Graphs & Multi-graphs, Directed Graphs, Sequential Representations of Graphs, Adjacency Matrices, Traversal, Connected Component and Spanning Trees, Minimum Cost Spanning Trees. **File Structures**: Physical Storage Media File Organization, Organization of records into Blocks, Sequential Files, Indexing and Hashing, Primary indices, Secondary indices, B+ Tree index Files, B Tree index Files, Indexing and Hashing Comparisons.	6

PRACTICALS	
1	Sorting programs: Bubble sort, Merge sort, Insertion sort, Selection sort, and Quick sort.

2	Searching programs: Linear Search, Binary Search
3	Array implementation of Stack, Queue, Circular Queue, Linked List.
4	Implementation of Stack, Queue, Circular Queue, Linked List using dynamic memory allocation.
5	Implementation of Binary tree.
6	Program for Tree Traversals (preorder, inorder, postorder).
7	Program for graph traversal (BFS, DFS).
8	Program for minimum cost spanning tree, shortest path.

REFERENCE BOOKS :		
1.	Data Structures using C and C++	Y. Langsam, M. Augenstin and A. Tannenbaum,
2.	Mehta Fundamentals of Data Structures in C++	Ellis Horowitz, S. Sahni, D, Galgotia Book Source,
3.	Data Structures	S. Lipschutz, Mc-Graw Hill International Editions, 1986.
4.	An introduction to data structures with Applications,	Jean-Paul Tremblay, Paul. G. Soresan, Tata Mc-Graw Hill
5.	Data structures via C++	A. Michael Berman,Oxford University Press, 2002.

MCA 123 OBJECT ORIENTED PROGRAMMING & C++

L	T	P	C
2	1	2	4

RATIONALE
Object-oriented programming, or OOP, is an approach to problem solving where all computations are carried out using objects.

UNITS	CONTENTS	Contact Hrs.

I	**Object Modeling** Object & classes, Links and Associations, Generalization and Inheritance, Aggregation, Abstract classes, A sample object model, Multiple Inheritance, Meta data, candidate keys, constraints.	**8**
II	**Dynamic Modeling** Events and States, Operations and Methods, Nested state Diagrams, Concurrency, Relation of Object and Dynamic Models, advanced dynamic model concepts, a sample dynamic model.	**7**
III	**Functional Modeling** Functional Models, Data flow Diagrams, Specifying Operations, Constraints, a sample functional model.	**9**
IV	**Programming in C++** Classes and objects in C++, Functions, Constructors, Destructors, Inheritance, Functions overloading, Operator Overloading, I/O Operations. Real life applications, Extended Classes, Pointer, Virtual functions, Polymorphisms, Working with files, Class templates, Function templates.	**7**
V	**Programming in C++** Classes and objects in C++, Functions, Constructors, Destructors, Inheritance, Functions overloading, Operator Overloading, I/O Operations. Real life applications, Extended Classes, Pointer, Virtual functions, Polymorphisms, Working with files, Class templates, Function templates.	**9**

PRACTICALS	
1	Program illustrating overloading of various operators.
2	Program illustrating use of Friend, Inline, Static Member functions, default arguments.
3	Program illustrating use of destructor and various types of constructor.
4	Program illustrating various forms of Inheritance.
5	Creating Forms, Reports etc.
6	Program illustrating use of virtual functions, virtual Base Class.
7	Program illustrating how exception handling is done.

REFERENCE BOOKS :		
1.	C++ Programming Language	Bjarne Stroustrup, Addison Wesley
2.	Object Oriented Programming with C++	E. Balagurusamy , TMH, 2001
3.	Object Oriented Analysis and Design with application	Booch Grady 3/e", Pearson
4.	C++ Primer Reading	Lipman, Stanley B, Jonsce Lajole, , AWL, 1999
5.	Object Oriented Conceptual Modeling	Dillon and Lee, New Delhi PHI-1993
6.	Object Oriented Design and Modeling	Rambaugh James etal, PHI-1997

MCA-124 OPERATING SYSTEMS

L	T	P	Cr
3	1	0	4

RATIONALE
This course provides a comprehensive introduction to understand the underlying principles, techniques and approaches which constitute a coherent body of knowledge in operating systems. In particular, the course will consider inherent functionality and processing of program execution. The emphasis of the course will be placed on understanding how the various elements that underlie operating system interact and provides services for execution of application software.

UNITS	CONTENTS	Contact Hrs.

I	**Introduction:** Definition and types of operating systems, Batch Systems, multi programming, time–sharing parallel, distributed and real-time systems, Operating system structure, Operating system components and services, System calls, system programs, Virtual machines.	8
II	**Process Management:** Process concept, Process scheduling, Cooperating processes, Threads, Interprocess communication, CPU scheduling criteria, Scheduling algorithms, Multiple-processor scheduling, Real-time scheduling and Algorithm evaluation.	7
III	**Process Synchronization and Deadlocks:** The Critical-Section problem, synchronization hardware, Semaphores, Classical problems of synchronization, Critical regions, Monitors, Deadlocks-System model, Characterization, Deadlock prevention, Avoidance and Detection, Recovery from deadlock, Combined approach to deadlock handling.	8
IV	**Storage management:** Memory Management-Logical and Physical Address Space, Swapping, Contiguous Allocation, Paging, Segmentation with paging in MULTICS and Intel 386, Virtual Memory, Demand paging and its performance, Page replacement algorithms, Allocation of frames, Thrasing, Page Size and other considerations, Demand segmentation, File systems, secondary Storage Structure, File concept, access methods, directory implementation, Efficiency and performance, recovery, Disk structure, Disk scheduling methods, Disk management, Recovery, Disk structure, disk scheduling methods, Disk management, Swap-Space management, Disk reliability.	8
V	**Security & Case Study:** Protection and Security-Goals of protection, Domain of protection, Access matrix, Implementation of access Matrix, Revocation of Access Rights, language based protection, The Security problem, Authentication, One Time passwords, Program threats, System threats, Threat Monitoring, Encryption. Windows NT-Design principles, System components, Environmental subsystems, File system, Networking and program interface, Linux system-design principles, Kernel Modules, Process Management, Scheduling, Memory management, File Systems, Input and Output, Interprocess communication, Network structure, security	9

REFERENCE BOOKS :		
1.	Operating System Concepts	Abraham Siberschatz and Peter Baer Galvin
2.	Operating Systems, Concepts and Design	Milan Milankovic, McGraw-Hill.
3.	Operating Systems"	Harvey M Deital, Addison Wesley.
4.	Linux: The Complete Reference"	Richard Peterson, Osborne McGraw-Hill

MCA-125 ARTIFICIAL INTELLIGENCE (Departmental Elective-II)

L	T	P	CR
3	1	0	4

RATIONALE
Understanding the term "artificial intelligence" is applied when a machine mimics "cognitive" functions that humans associate with other human minds, such as "learning" and "problem solving".

UNITS	CONTENTS	Contact Hrs.
I	Introduction :: Introduction to Artificial Intelligence, Foundations and History of Artificial Intelligence, Applications of Artificial Intelligence, Intelligent Agents, Structure of Intelligent Agents. Computer vision, Natural Language Possessing.	08

II	Introduction to Search : Searching for solutions, Uniformed search strategies, Informed search strategies, Local search algorithms and optimistic problems, Adversarial Search, Search for games, Alpha - Beta pruning.	08
III	Knowledge Representation &Reasoning: Propositional logic, Theory of first order logic, Inference in First order logic, Forward & Backward chaining, Resolution, Probabilistic reasoning, Utility theory, Hidden Markov Models (HMM), Bayesian Networks.	08
IV	Machine Learning : Supervised and unsupervised learning, Decision trees, Statistical learning models, Learning with complete data - Naive Bayes models, Learning with hidden data - EM algorithm, Reinforcement learning,	07
V	Pattern Recognition : Introduction, Design principles of pattern recognition system, Statistical Pattern recognition, Parameter estimation methods - Principle Component Analysis (PCA) and Linear Discriminant Analysis (LDA), Classification Techniques – Nearest Neighbor (NN) Rule, Bayes Classifier, Support Vector Machine (SVM), K –means clustering.	09

REFERENCE BOOKS :		
1.	Artificial Intelligence – A Modern Approach	Stuart Russell, Peter Norvig,, Pearson Education
2.	Artificial Intelligence	Elaine Rich and Kevin Knight, Tata Mcgraw
3.	Introduction to Artificial Intelligence	E.Charniak and D McDermott, Pearson Education
4.	Artificial Intelligence and Expert Systems	Dan W. Patterson, Prentice Hall of India.

MCA-125 E-COMMERCE

L	T	P	CR
3	1	0	4

RATIONALE
The objectives of the course are to introduce the concept of electronic commerce, and to understand how electronic commerce is affecting business enterprises, governments, consumers and people in general. In addition, we will study the development of websites using relevant software tools.

UNITS	CONTENTS	Contact Hrs.
I	**Introduction:** Electronic Commerce - Technology and Prospects, Definition of E-Commerce, Economic potential of electronic commerce, Incentives for engaging in electronic commerce, forces behind ECommerce, Advantages and Disadvantages, Architectural framework, Impact of E-commerce on business. **Network Infrastructure for E- Commerce:** Internet and Intranet based E-commerce-Issues, problems and prospects, Network Infrastructure, Network Access Equipments, Broadband telecommunication (ATM, ISDN, FRAME RELAY).	9

II	**Mobile Commerce:** Introduction, Wireless Application Protocol, WAP technology, Mobile Information device, Mobile Computing Applications.	8
III	**Web Security:** Security Issues on web, Importance of Firewall, components of Firewall, Transaction security, Emerging client server, Security Threats, Network Security, Factors to consider in Firewall design, Limitation of Firewalls.	9
IV	**Encryption:** Encryption techniques, Symmetric Encryption- Keys and data encryption standard, Triple encryption, Asymmetric encryption- Secret key encryption, public and private pair key encryption, Digital Signatures, Virtual Private Network.	7
V	**Electronic Payments:** Overview, The SET protocol, Payment Gateway, certificate, digital Tokens, Smart card, credit card, magnetic strip card, E-Checks, Credit/Debit card based EPS, online Banking. EDI Application in business, E- Commerce Law, Forms of Agreement, Govt. policies and Agenda.	7

REFERENCE BOOKS:		
1.	Frontiers of Electronic Commerce", Addison Wesley.	Ravi Kalakota, Andrew Winston
2.	E-Commerce the cutting edge of Business", TM	Bajaj and Nag
3.	Electronic commerce", Firewall Media, New Delhi	P. Loshin, John Vacca,

MCA-125 IMAGE PROCESSING

L	T	P	C
3	1	0	4

RATIONALE
The goal of the subject is to familiarize students with the concepts and implementation issues of how the image is processed digitally using the various image processing operations namely, image enhancement techniques (like contrast stretching, smoothing etc.), image restoration techniques, feature extraction etc. Students will gain an understanding of how to compress the image so that the number of bits required storing the image gets reduced.

UNITS	CONTENTS	Contact Hrs.
I	Image digital representation. Elements of visual perception. Sampling and quantization. Image processing system elements.	11
II	Fourier transforms. Extension to 2-D, DCT, Walsh transform, Hadamard transforms. Enhancement and segmentation. Point and region dependent techniques.	11
III	Image encoding: Fidelity criteria. Transform compression. KL, Fourier, DCT, Spatial compression, Run length coding. Huffman and contour coding.	09
IV	Restoration Models: Constrained & unconstrained, Inverse filtering, Least squares filtering, Recursive filtering.	09

REFERENCE BOOKS :		
1.	Digital Image Processing	Rafael C. Gonzalvez and Richard E. Woods.
2.	Digital Image Processing and Computer Vision	R.J. Schalkoff., Published by: John Wiley and Sons
3.	Fundamentals of Digital Image Processing	A.K. Jain., Published by Prentice Hall

MCA-211 COMPUTER NETWORKS

L	T	P	C
3	1	0	4

RATIONALE

The future of computer technology is in computer networks. Global connectivity can be achieved through computer networks. It is important to understand the function of computer networks. Knowledge about hardware and software requirements of networks is essential. The emphasis of the course is towards the various components and software required to make a network operational.

UNITS	CONTENTS	Contact Hrs.
I	**Introductory Concepts:** Goals and Applications of Networks, Network structure and architecture, the OSI reference model, services, networks topology, Physical Layer-transmission, switching methods, Integrated services digital networks, terminal handling.	7
II	**Medium access sub layer:** Channel allocations, LAN protocols, ALOHA Protocols- Pure ALOHA, slotted ALOHA, Carrier Sense Multiple Access Protocols, CSMA with Collision Detection, Collision free Protocols, IEEE standards, FDDI, Data Link Layer- elementary data link protocols, sliding windows protocols, error handling, High Level Data Link Control	8
III	**Network Layer:** Point-to Point networks, routing algorithms, congestion control algorithms, internetworking, TCP/IP packet, IP addresses, IPv6.	9
IV	**Transport Layer:** Design issues, connection management, TCP window Management, User Datagram Protocol, Transmission Control Protocol.	8
V	**Application Layer:** Network Security, DES, RSA algorithms, Domain Name System, Simple Network Management Protocol, Electronic mail, File Transfer Protocol, Hyper Text Transfer Protocol, Cryptography and compression Techniques.	8

	REFERENCE BOOKS :	
1.	Data and Computer Communication"	W. Stallings, , Macmillan Press
2.	Computer Networks & Internet"	Comer, PHI.
3.	Internetworking with TCP/IP"	Comer PHI.
4.	Data Communication and Networking"	Forouzan, , TMH

MCA-212 DESIGN & ANALYSIS OF ALGORITHMS

L	T	P	C
2	1	2	4

RATIONALE
This subject will enable the students to have awareness about Basic Design and Analysis techniques of Algorithms, Sorting Techniques , Data Structures etc.

UNITS	CONTENTS	Contact Hrs.
I	**Introduction:** Algorithms, Analysis of Algorithms, Design of Algorithms, and Complexity of Algorithms, Asymptotic Notations, Growth of function, Recurrences Sorting in polynomial Time: Insertion sort, Merge sort, Heap sort, and Quick sort Sorting in Linear Time: Counting sort, Radix Sort, Bucket Sort Medians and order statistics	8
II	**Elementary Data Structure:** Stacks, Queues, Linked list, Binary Search Tree, Hash Table **Advanced Data Structure:** Red Black Trees, Splay Trees, Augmenting Data Structure Binomial Heap, BTree, Fibonacci Heap, and Data Structure for Disjoint Sets Union-find Algorithm, Dictionaries and priority Queues, mergeable heaps, concatenable queues	8
III	**Advanced Design and Analysis Techniques:** Dynamic programming, Greedy Algorithm, Backtracking, Branch-and-Bound, Amortized Analysis	7
IV	**Graph Algorithms**: Elementary Graph Algorithms, Breadth First Search, Depth First Search, Minimum Spanning Tree, Kruskal's Algorithms, Prim's Algorithms, Single Source Shortest Path, All pair Shortest Path, Maximum flow and Traveling Salesman Problem	9
V	Randomized Algorithms, String Matching, NP-Hard and NP-Completeness Approximation Algorithms, Sorting Network, Matrix Operations, Polynomials & the FFT, Number Theoretic Algorithms, Computational Geometry	8

PRACTICALS	
1	Creation of a binary search tree and insertion & deletion into it.
2	Creation of a Red Black tree and all the associated operations on it.
3	Implementing an AVL tree and all the associated operations on it.
4	Multiplication of two matrices using Strassen's Matrix Multiplication method.
5	Solving Knapsack problem.
6	Implementing shortest path algorithms (Dijkastra's and Bellman Ford Algorithm).
7	Finding the minimum cost Spanning Tree in a connected graph.
8	Solving 8 Queen's problem.
9	Finding the number of connected components in a Graph.

REFERENCE BOOKS :		
1.	Introduction to Algorithms	T.H. Cormen, Charles E. Leiserson, Ronald L. Rivest,
2.	Introduction to Design and Analysis	Sarabasse & A.V. Gelder Computer Algorithm
3.	"Data Structures and algorithm in C++",	Adam Drozdek Third Edition, Cengage Learning, 2012.
4.	Data Structures, "Algorithms and applications in C++"	SartajSahni, Second Edition, Universities Press, 2011.

MCA-213 SOFTWARE ENGINEERING

L	T	P	C
3	1	0	4

RATIONALE
This subject will enable the students to have awareness about software engineering, various matrics, planning about software, cost estimation, software design etc.

UNITS	CONTENTS	Contact Hrs.
I	**Introduction:** Introduction to software engineering, Importance of software, The evolving role of software, Software Characteristics, Software Components, Software Applications, Software Crisis,Software engineering problems, Software Development Life Cycle, Software Process.	6
II	**Software Requirement Specification:** Analysis Principles, Water Fall Model, The IncrementalModel, Prototyping, Spiral Model, Role of management in software development, Role of matrices and Measurement, Problem Analysis, Requirement specification, Monitoring and Control. **Software-Design:** Design principles, problem partitioning, abstraction, top down and bottom up-design,Structured approach, functional versus object oriented approach, design specifications and verification,Monitoring and control, Cohesiveness, coupling, Forth generation techniques, Functional independence,Software Architecture, Transaction and Transform Mapping, Component – level Design, Forth GenerationTechniques	8
III	**Coding:** Top-Down and Bottom –Up programming, structured programming, information hiding,programming style and internal documentation. **Testing:** Testing principles, Levels of testing, functional testing, structural testing, test plane, test case specification, reliability assessment, software testing strategies, Verification & validation, Unit testing,Integration Testing, Alpha & Beta testing, system testing and debugging.	9
IV	**Software Project Management:** The Management spectrum- (The people, the product, the process, the project), cost estimation, project scheduling, staffing, software configuration management,Structured Vs. Unstructured maintenance, quality assurance, project monitoring, risk management.	8

V	**Software Reliability & Quality Assurance:** Reliability issues, Reliability metrics, Reliability growth modeling, Software quality, ISO 9000 certification for software industry, SEI capability maturity model, comparison between ISO & SEI CMM. **CASE (Computer Aided Software Engineering):** CASE and its Scope, CASE support in software life cycle, documentation, project management, internal interface, Reverse Software Engineering, Architecture of CASE environment.	9

REFERENCE BOOKS :		
1.	Software Engineering: A Practitioner's Approach	Pressman, Roger S. Ed. Boston: McGraw Hill, 2001
2.	Software Engineering	Jalote, Pankaj Ed.2", New Delhi: Narosa 2002
3.	Software Engineering"	Schaum's Series, TMH

MCA-214 INTERNET & JAVA PROGRAMMING

L	T	P	CR
2	1	2	4

RATIONALE
This subject aims to introduce students to the Java programming language. Upon successful completion of this subject, the students should be able to create Java programs that leverage the object-oriented features of the Java language, such as encapsulation, inheritance and polymorphism; use data types, arrays and other data collections; implement error-handling techniques using exception handling, create and event-driven GUI using Swing components; and implement I/O functionality to read from and write to text files.

UNITS	CONTENTS	Contact Hrs.
I	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.	7
II	Core Java: Introduction, Operator, Data type, Variable, 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.	10
III	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, Lists, Combo box, Progress Bar, Menus and Toolbars, Layered Panes, Tabbed Panes, Split Panes, Layouts, Windows, Dialog Boxes, Inner frame. JDBC: The connectivity Model, JDBC/ODBC Bridge, (5)java.sql package, connectivity to remote database, navigating through multiple rows retrieved from a database.	7
IV	Java Beans: Application Builder tools, The bean developer kit(BDK), JAR files, Introspection, 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	8

	Invocation): A simple client-server application using RMI.	
V	Java Servlets: Servlet basics, Servlet API basic, Life cycle of a Servlet, Running Servlet, Debugging Servlets, Thread-safe Servlets, HTTP Redirects, Cookies, Introduction to Java Server pages (JSP).	8

PRACTICALS	
1	Write a program in Java for illustrating, overloading, over riding and various forms of inheritance.
2	Write programs to create packages and multiple threads in Java.
3	Write programs in Java for event handling Mouse and Keyboard events.
4	Using Layout Manager create different applications.
5	Write programs in Java to create and manipulate Text Area, Canvas, Scroll Bars, Frames and Menus using swing/AWT.
6	. Using Java create Applets.
7	Use Java Language for Client Server Interaction with stream socket connections.
8	Write a program in java to read data from disk file.

REFERENCE BOOKS :		
1.	The Complete Reference Internet"	Margaret Levine Young,, Tata Mcgraw
2.	Object Oriented Programming inJAVA"	Thampi, Wiley Dreamtech Publication.
3.	Programming in JAVA"	E.Balagurusamy, Tata Mcgraw-hill Education Pvt. Ltd.
4.	Inside Servlets"	Dustin R. Callway,, Addison Wesley
5.	Java Enterprise Edition"	Mark Wutica,, QUE.

MCA-215 ADVANCED DATABASE MANAGEMENT SYSTEMS

L	T	P	CR
3	1	0	4

RATIONALE
Objective of this subject is to have a clear understanding of query Processing and optimization along with to have an idea of latest advancement in the domain of DBMS.

UNITS	CONTENTS	Contact Hrs
I	Query Processing, Optimization & Database Tuning:Algorithms For Executing Query Operations.Heuristics For Query Optimizations, Estimations Of QueryProcessing Cost, Join Strategies For Parallel Processors, Database Workloads, Tuning Decisions, DBMS Benchmarks, Clustering & Indexing, Multiple Attribute Search Keys, Query Evaluation Plans, Pipelined Evaluations, System Catalogue In RDBMS.	9
II	Extended Relational Model & Object Oriented Database System:New Data Types, User Defined Abstract Data Types, Structured Types, Object Identity, Containment,Class Hierarchy, Logic Based Data Model, Data Log, Nested Relational Model And Expert Database System.	8
III	**Distributed Database System:** Structure Of Distributed Database, Data Fragmentation, Data Model, Query Processing, Semi Join, Parallel & Pipeline Join, Distributed Query Processing In R * System, Concurrency Control In Distributed Database System, Recovery In Distributed Database System, Distributed Deadlock Detection And Resolution, Commit Protocols.	8
IV	Enhanced Data Model For Advanced Applications: Database Operating System, Introduction To Temporal Database Concepts, Spatial And Multimedia Databases, Data Mining, Active Database System, Deductive Databases, Database Machines, Web Databases, Advanced Transaction Models, Issues In Real Time Database Design.	8
V	**Introduction To Expert Database And Fuzzy Database System:** **Expert DataBases**: Use of Rules of Deduction in Databases, Recursive Rules. **Fuzzy DataBases**: Fuzzy Set & Fuzzy Logic, Use Of Fuzzy Techniques to Define Inexact and	7

	Incomplete Databases.	

REFERENCE BOOKS :

1.	Database Management System	Majumdar & Bhattacharya, TMH.
2.	Database Concepts	Korth, Silbertz, Sudarshan,, McGraw Hill.
3.	Elmasri, Navathe, "Fundamentals Of Database Systems	Elmasri, Navathe, Addison Wesley.
4.	Database Management System	Ramakrishnan, Gehrke, McGraw Hill.

MCA-215 INFORMATION STORAGE & MANAGEMENT

L	T	P	C
3	1	0	4

RATIONALE

This subject will enable the students to have awareness Storage Technology , Storage Systems Architecture, Networked Storage etc

UNITS	CONTENTS	Contact Hrs
I	Introduction to Storage Technology Data proliferation and the varying value of data with time & usage, Sources of data and states of data creation, Data center requirements and evolution to accommodate storage needs, Overview of basic storage management skills and activities, The five pillars of technology, Overview of 12 storage infrastructure components, Evolution of storage, Information Lifecycle Management concept, Data categorization within an enterprise, Storage and Regulations.	9
II	Storage Systems Architecture Intelligent disk subsystems overview, Contrast of integrated vs. modular arrays, Component architecture of intelligent disk subsystems, Disk physical structure components, properties, performance, and specifications, Logical partitioning of disks, RAID & parity algorithms, hot sparing, Physical vs. logical disk organization, protection, and back end management, Array caching properties and algorithms, Front end connectivity and queuing properties, Front end to host storage provisioning, mapping, and operation, Interaction of file systems with storage, Storage system connectivity protocols.	8
III	Introduction to Networked Storage JBOD, DAS, SAN, NAS, & CAS evolution, Direct Attached Storage (DAS) environments: elements, connectivity, & management, Storage Area Networks (SAN): elements & connectivity, Fibre Channel principles, standards, & network management principles, SAN management principles, Network Attached Storage (NAS): elements, connectivity options, connectivity protocols (NFS, CIFS, ftp), & management principles, IP SAN elements, standards (SCSI, FCIP, FCP), connectivity principles, security, and management principles, Content Addressable Storage (CAS): elements, connectivity options, standards, and management principles, Hybrid Storage solutions overview including technologies like virtualization & appliances.	8
IV	Introduction to Information Availability Business Continuity and Disaster Recovery Basics, Local business continuity techniques, Remote business continuity techniques, Disaster Recovery principles & techniques.	8

V	Managing & Monitoring Management philosophies (holistic vs. system & component), Industry management standards (SNMP, SMI-S, CIM), Standard framework applications, Key management metrics (thresholds, availability, capacity, security, performance), Metric analysis methodologies & trend analysis, Reactive and pro-active management best practices, Provisioning & configuration change planning, Problem reporting, prioritization, and handling techniques, Management tools overview.	7

REFERENCE BOOKS :

1.	Information Storage and Management Storing, Managing, and Protecting Digital Information	EMC, Hopkinton and Massachusetts, Wiley, ISBN: 9788126521470

MCA-215 CLOUD COMPUTING

L	T	P	C
3	1	0	4

RATIONALE

This subject will enable the students to have knowledge Vision of Cloud Computing , Cloud Computing Architecture , Cloud Management & Virtualization Technology etc.

UNITS	CONTENTS	Contact Hrs
I	Introduction: Historical development ,Vision of Cloud Computing, Characteristics of cloud computing as per NIST , Cloud computing reference model ,Cloud computing environments, Cloud services requirements, Cloud and dynamic infrastructure, Cloud Adoption and rudiments .Overview of cloud applications: ECG Analysis in the cloud, Protein structure prediction, Gene Expression Data Analysis ,Satellite Image Processing ,CRM and ERP ,Social networking .	9
II	Cloud Computing Architecture: Cloud Reference Model, Types of Clouds, Cloud Interoperability & Standards, Scalability and Fault Tolerance; Cloud Solutions: Cloud Ecosystem, Cloud Business Process Management, Cloud Service Management. Cloud Offerings: Cloud Analytics, Testing Under Control, Virtual Desktop Infrastructure.	8
III	Cloud Management & Virtualization Technology: Resiliency, Provisioning, Asset management,Conceps of Map reduce , Cloud Governance, High Availability and Disaster Recovery. Virtualization: Fundamental concepts of compute ,storage, networking, desktop and application virtualization .Virtualization benefits, server virtualization, Block and file level storage virtualization Hypervisor management software, Infrastructure Requirements , Virtual LAN(VLAN) and Virtual SAN(VSAN) and their benefits .	8
IV	Cloud Security: Cloud Information security fundamentals, Cloud security services, Design principles, Secure Cloud Software Requirements, Policy Implementation, Cloud Computing Security Challenges, Virtualization security Management, Cloud Computing Security Architecture .	8
V	Market Based Management of Clouds , Federated Clouds/Inter Cloud: Characterization & Definition ,Cloud Federation Stack , Third Party Cloud Services .Case study : Google App Engine, Microsoft Azure , Hadoop , Amazon , Aneka.	7

REFERENCE BOOKS :		
1.	Mastering Cloud Computing	Buyya, Selvi ,TMH Pub
2.	Cloud Computing"	Kumar Saurabh, Wiley Pub
3.	Cloud Security "	Krutz , Vines, Wiley Pub