Revised Syllabus

Master of Computer Applications (MCA)

Centre of Computer Education

Institute of Professional Studies
University of Allahabad
Allahabad

REVISED STRUCTURE OF
MASTER OF COMPUTER APPLICATIONS (M.C.A) CURRICULUM

Semester I:

1. Discrete Mathematical Structures (MCA501)
2. Accounting & Financial Management (MCA502)
3. Digital Electronics & Computer Organization (MCA503)
4. Combinatorics & Graph Theory (MCA504)
5. Programming In 'C' (MCA505)
6. Linux & Shell Programming (MCA506)

Lab I : Programming in C in Linux environment
Lab II : Digital Electronics and Assembly Language Lab.
Lab.III : Communication Skills Lab.

Semester II:

1. Organizational Management & MIS (MCA507)
2. Data & File Structure Using 'C' (MCA508)
3. Database Management System (MCA509)
4. Operating Systems (MCA510)
5. Object Oriented Methodology using C++ (MCA511)
6. Theory of Computation (MCA512)

Lab I : Data Structures Lab.
Lab II: Programming in C++
Lab.III: Oracle Lab.

Semester III:

1. Software Engineering & Case Tools (MCA513)
2. Design & Analysis of Algorithms (MCA514)
3. Web Technologies using JAVA (MCA515)
4. Computer Graphics (MCA516)
5. Numerical Methods (MCA517)
6. Advanced Computer Architecture (MCA518)

Lab I : Programming in Java
Lab II: Computer Graphics Lab.
Lab.III: Systems Programming Lab.

Semester IV:

1. .NET Framework & C# (MCA519)
2. Multimedia Systems (MCA520)
3. Embedded Systems (MCA521)
4. Operation Research (MCA522)
5. System Programming (MCA523)
6. Data Communication & Networks (MCA524)

Lab I : Programming in C#
Lab II: Networks Lab.
Lab.III: System Design Lab.

Semester V:

1. Image Processing (MCA525)
2. Information Retrieval & Web Mining (MCA526)
3. Artificial Intelligence (MCA527)
4. Digital Communication (MCA528)
5. Secure Computing (MCA529)

Lab I: MINI PROJECT
Lab II: Image Processing Lab.

Semester VI:

1. Mobile Computing & Applications (MCA530)
2. Elective: Cloud Computing, E-commerce & Cyber laws/ High Performance Computing/Human Computer Interaction/ Application Development on Hand-held devices/ Computer Animation/Natural Language Processing/Computer Vision/Artificial Neural Networks/Fuzzy Systems/ Distributed Computing (MCA531)

Lab.: MAIN PROJECT

CREDIT STRUCTURE OF Master of Computer Applications (MCA)

SEMESTER-I

S.No	Course Code	Course Title	L	T	P	C
		THEORY				
1	**MCA501**	Discrete Mathematical Structures	2	1	0	3
2	**MCA502**	Accounting & Financial Management	2	1	0	3
3	**MCA503**	Digital Electronics & Computer Organization	2	1	0	3
4	**MCA504**	Combinatorics & Graph Theory	2	1	0	3
5	**MCA505**	Programming In 'C'	2	1	0	3
6	**MCA506**	Linux & Shell Programming	2	1	0	3
7	**MCA631**	**Practical**	0	1	5	6
		TOTAL	**12**	**07**	**05**	**24**

SEMESTER-II

S.No	Course Code	Course Title	L	T	P	C
		THEORY				
1	**MCA507**	Organizational Management & MIS	2	1	0	3
2	**MCA508**	Data & File Structure Using 'C'	2	1	0	3
3	**MCA509**	Database Management System	2	1	0	3
4	**MCA510**	Operating Systems	2	1	0	3
5	**MCA511**	Object Oriented Methodology using C++	2	1	0	3
6	**MCA512**	Theory of Computation	2	1	0	3
7	**MCA632**	**Practical**	0	1	5	6
		TOTAL	**12**	**07**	**05**	**24**

SEMESTER-III

S.No	Course Code	Course Title	L	T	P	C
		THEORY				
1	**MCA513**	Software Engineering & Case Tools	2	1	0	3
2	**MCA514**	Design & Analysis of Algorithms	2	1	0	3
3	**MCA515**	Web Technologies using JAVA	2	1	0	3
4	**MCA516**	Computer Graphics	2	1	0	3
5	**MCA517**	Numerical Methods	2	1	0	3
6	**MCA518**	Advanced Computer Architecture	2	1	0	3
7	**MCA633**	**Practical**	0	1	5	6
		TOTAL	**12**	**07**	**05**	**24**

SEMESTER-IV

S.No	Course Code	Course Title	L	T	P	C
		THEORY				
1	**MCA519**	.NET Framework & C#	2	1	0	3
2	**MCA520**	Multimedia Systems	2	1	0	3
3	**MCA521**	Embedded Systems	2	1	0	3
4	**MCA522**	Operation Research	2	1	0	3
5	**MCA523**	System Programming	2	1	0	3
6	**MCA524**	Data Communication & Networks	2	1	0	3
7	**MCA634**	**Practical**	0	1	5	6
		TOTAL	**12**	**07**	**05**	**24**

SEMESTER-V

S.No	Course Code	Course Title	L	T	P	C
		THEORY				
1	**MCA525**	Image Processing	2	1	0	3
2	**MCA526**	Information Retrieval & Web Mining	2	1	0	3
3	**MCA527**	Artificial Intelligence	2	1	0	3
4	**MCA528**	Digital Communication	2	1	0	3
5	**MCA529**	Secure Computing	2	1	0	3
6	**MCA635**	**Mini Project**	0	0	12	12
		TOTAL	**10**	**5**	**12**	**27**

SEMESTER-VI

S.No	Course Code	Course Title	L	T	P	C
		THEORY				
1	**MCA530**	Mobile Computing & Applications	3	1	0	4
2	**MCA531**	Application Development on Hand-held devices	3	1	0	4
3	**MCA636**	**Main Project**	0	0	12	12
4	**MCA637**	**Comprehensive Viva**	0	3	0	3
		TOTAL	**6**	**5**	**12**	**23**

DETAILED STRUCTURE OF MCA CURRICULUM

Semester I:

Paper-1: Discrete Mathematical Structures (MCA501)

8 Lectures

1. **Mathematical Logic:** Introduction, Statements and notation, Connectives, Statement formula and truth tables, Well-formed formula, duality law, Tautological implications, Functionally complete set of connectives Normal forms: conjunctive and disjunctive normal forms, Principal conjunctive and disjunctive normal forms, Ordering & uniqueness of normal forms; Predicate Calculus: Predicates, Statement function, Variables & quantifiers, Predicate formulas, Theory of inference for the predicate calculus.

8 Lectures

2. **Set Theory, Relations and Functions:** Basic concepts of set theory, Finite & Infinite sets, Equality of sets, the power set, Venn Diagrams, Cartesian Products, Cardinality of sets; Definition and properties of relations & functions, Matrix & Graph representation of relations, Covering of set equivalence relations, Composition of relation & functions, Inverse function, Characteristic function of a set.

8 Lectures

3. **Principle of inclusion & exclusion:** First principle, Inclusion & Exclusion principle in general & their applications.

8 Lectures

4. **Algebraic structures:** Overview of Group theory, Semi group, Monoid, Groupoid, Finite & Infinite group, Abelian group and their examples.

8 Lectures

5. **Latices and Boolean Algebra:** Poset, Hasse diagram, Elements of Poset, Bounds, Lattices, Join, Meet, Different types of lattices and their examples.

References:

1. Logic for CS by Gallier
2. Discrete Maths by Tremblay Manohar
3. Discrete Maths by Stanat
4. Laws of Logical Calculi by Morgan

Paper-2: Accounting & Financial Management (MCA502)

8 Lectures

1. **Accounting:** Principles, concepts and conventions, double entry system of accounting, Ledger posting and Trial balance; Final accounts**:** Trading, profit and loss accounts and balance sheet of sole proprietary concern with normal closing entries; Introduction to manufacturing account, final account of partnership firms, limited company.

8 Lectures

2. **Financial Management:** Basic Financial concepts: Time value of Money, present value, future value of a series of cash flows, annuity; Practical applications of compounding and present value techniques; Long-term sources of finance: Introduction to shares, debentures, preference shares; Management: Meaning, role and scope of financial management.

8 Lectures

3. **Capital Budgeting and Analysis:** Meaning, importance, difficulties; Introduction to evaluation techniques: Traditional techniques (ARR Payback method); Discounting cash flow techniques (Present value, NPV, IRR); Ratio Analysis: Meaning, advantages, limitations of ratio analysis, Types of ratios and their usefulness.

8 Lectures

4. **Costing**: Nature, importance and types of cost; Marginal costing: Nature, scope and importance of marginal costing, Break-even analysis, its uses and limitations, construction of break-even charts; Practical applications of marginal costing; Meaning, role and scope of financial management: The need, cost of inventory, methods of inventory costing.

8 Lectures

5. **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.

References:

1. S.N. Maheswari & S. K. Maheswari, "Introduction to Financial Accountancy", Vikas Publication.
2. S.N. Maheswari & S. K. Maheswari, "Advanced Accountancy", Vikas Publication.
3. S.N. Maheswari & S. K. Maheswari, "Financial Management", Viaks Publication.

Paper-3: Digital Electronics & Computer Organization (MCA503)

8 Lectures

1. **Representation of Information and Basic Building Blocks:** Introduction to Computer, Computer hardware generation, Number System: Binary, Octal, Hexadecimal, Character Codes (BCD, ASCII, EBCDIC), Logic gates, Boolean Algebra, K-map simplification, Half Adder, Full Adder, Subtractor, Decoder, Encoders, Multiplexer, Demultiplexer, Carry lookahead adder, Combinational logic Design, Flip-Flops, Registers, Counters (synchronous & asynchronous), Design of ALU, Computer Arithematic.

8 Lectures

2. **Basic Organization:** Von Neumann Machine (IAS Computer), Operational flow chart (Fetch, Execute), Instruction Cycle, Organization of Central Processing Unit, Hardwired & micro programmed control unit, Single Organization, General Register Organization, Stack Organization, Addressing modes, Instruction formats, data transfer & Manipulation, I/O Organization, Bus Architecture, Programming Registers; ALU- chip, Faster Algorithm and Implementation (multiplication & Division).

8 Lectures

3. **Memory Organization:** Memory Hierarchy, Main memory (RAM/ROM chips), Auxiliary memory, Associative memory, Cache memory, Virtual Memory, Memory Management Hardware, hit/miss ratio, magnetic disk and its performance, magnetic Tape etc.

8 Lectures

4. **I/O Organization:** Peripheral devices, I/O interface, Modes of Transfer, Priority Interrupt, I/O methods, Input-Output Processor, Parallel and Serial Communication; I/O Controllers, Asynchronous data transfer, Strobe Control, Handshaking.

8 Lectures

5. **Process Organization:** Basic Concept of 8-bit micro Processor (8085) and 16-bit Micro Processor (8086), Assembly Instruction Set, Assembly language program of (8085): Addition of two numbers, Subtraction, Block Transfer, find greatest number, Table search, Numeric Manipulation, Introductory Concept of pipeline, Fault models, testing and design for testability.

References:

1. William Stalling, "Computer Organization & Architecture", Pearson education Asia
2. Mano Morris, "Computer System Architecture", PHI
3. Zaky & Hamacher, "Computer Organization", McGraw Hill
4. B. Ram, "Computer Fundamental Architecture & Organization", New Age
5. Tannenbaum, " Structured Computer Organization", PHI.

Paper-4: Combinatorics & Graph Theory (MCA504)

8 Lectures

1. Discrete numeric function and generating function, Combinatorial problems, Difference equation; Recurrence Relation-Introduction, Linear recurrence relation with constant coefficient, Homogeneous solution, Particular solution, Total solution, Solution by the method of generating function.

8 Lectures

2. Graphs, sub-graphs, some basic properties, Walks, Path & circuits, Connected graphs, Disconnected graphs and component, Eular and Hamiltonian graphs, Various operation on graphs, Tree and fundamental circuits, Distance diameters, Radius and pendent vertices, Rooted and binary trees, Counting trees, Spanning trees, Finding all spanning trees of a graph and a weighted graph.

8 Lectures

3. Cut-sets and cut vertices, some properties, All cut sets in a graph, Fundamental circuit and cut sets, Connectivity and seperatability, Network flows, mincut theorem, Planar graphs, Combinatorial and geometric dual, Kuratowski to graph detection of planarity, Geometric dual, Some more criterion of planarity, Thickness and Crossings, Vector space of a graph and vectors, basis vectors, cut set vector, circuit vector, circuit and cut set verses sub spaces, orthogonal vector and sub space.

8 Lectures

4. Incidence matrix of graphs, sub matrices of A(G), circuit matrix, cut set matrix, path matrix and relationship among A_f, B_f, C_f, fundamental circuit matrix and range of B_f adjacency matrix, rank nullity theorem.

8 Lectures

5. Coloring and covering partitioning of graph, Chromatic number, Chromatic partitioning, Chromatic polynomials, Matching, covering, Four color problem, Directed graph, Types of directed graphs, Directed paths and connectedness, Euler digraph, Trees with directed edges, Fundamental circuit in digraph, Matrices A, B, C of digraph adjacency matrix of digraph, Enumeration and its types, Counting of labeled and unlabeled trees, Polya's theorem, Graph enumeration with polyas theorem, Graph theoretic algorithm.

References:

1. Deo Narsing, "Graph Theory with applications to engineering & computer science", PHI
2. Tremblay & Manohar, " Discrete mathematical structures with applications to computerScience", TMH
3. Joshi K. D., "Fundamental of discrete mathematics", New Age International
4. John Truss, "Discrete mathematics for computer scientist"
5. C. L. Liu, "Discrete mathematics"

Paper-5: Programming in 'C' (MCA505)

8 Lectures

1. **Programming in C:** History, Introduction to C, Structure of C programs, Compilation & execution of C programs, Debugging techniques, Data types & sizes, Declaration of variables, Modifiers, Identifiers & keywords, Symbolic constants; Operators: Unary operators, Arithmetic & Logical operators, Bit-wise operators, Assignment operators and expressions, Conditional expressions, Precedence & order of evaluation; Storage classes: Automatic, External, Register & Static, Enumerations.

8 Lectures

2. **Control & Loop Statements**: If-else, Switch, Break, Continue, Comma operator, Go-to statement; Loops: For, While, Do-while; Functions: Built-in & User-defined, Function declaration, Definition & function call, Parameter passing: Call by value, Call by reference, Recursive functions, Multi-file programs.

8 Lectures

3. **Arrays & Pointers**: Linear arrays, Multi-dimensional arrays, Passing arrays to functions, Arrays & Strings; Structures & Union: Definition and differences, Self-referential structure; Pointers: Value at (*) and address of (&) operator, Pointer to pointer, Dynamic memory allocation, Calloc & Malloc functions, Array of pointers, Function of pointers, Structures and pointers, C Directives: Macros, C pre-processor.

8 Lectures

4. **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 Lectures

5. **File Handling in C**: Opening, Closing and creating a data file, Read and Write functions, Unformatted data files; Make Utility; Command line parameters**;** Insertion Sort, Bubble Sorting, Quick Sort, Counting Sort, Radix sort.

References:

1. Peter Norton's, DOS Guide, PHI
2. Gottfried, Programming in C, Schaum series, TMH
3. Yashwant Kanitkar, Let us C, BPB

Paper-6: Linux & Shell Programming (MCA506)

8 Lectures

1. **Introduction:** Introduction to LINUX, LINUX system organization (the kernel and the shell), Files and directories, Library functions and system calls, Editors (vi and ed).

8 Lectures

2. **LINUX Shell programming:** Types of Shells, Shell Meta characters, Shell variables, Shell scripts, Shell commands, the environment, Integer arithmetic and string Manipulation, Special command line characters, Decision making and Loop control, controlling terminal input, trapping signals, arrays.

8 Lectures

3. **Portability with C:** Command line Argument, Background processes, process synchronization, Sharing of data, user-id, group-id, pipes, fifos, message queues.

8 Lectures

4. **LINUX System Administration:** File System, mounting and unmounting file system, System booting, shutting down, handling user account, backup, recovery, security, creating files, storage of Files, Disk related commands.

8 Lectures

5. **Different tools and Debugger:** System development tools: lint, make, SCCS (source code control system), Language development tools: YACC, LEX, M4, Text formatting tools: nroff, troff, tbl, eqn, pic, Debugger tools: Dbx and Adb.

References:

1. Linux Networking & System Administration, Terry Collings and Kurt Wall (Wiley)
2. Red Hat Linux 9, Bill Ball and Hoyt Duff (Pearson Education)

Semester II:

Paper-1: Organizational Management & MIS (MCA507)

8 Lectures

1. **Organization Structure:** Classical theories of Management: Scientific management theory, Fayol's 14 principles of Management, Webar's bureaucratic theory; Definition of organization and organization Structure; Line and Staff authority, Centralization and Decentralization, Span of control, Formal and Informal Organization; Function based, Product based, Geography based, Project based (Matrix); Organization Design: Mechanistic and Organic Structure, Virtual and Network organization Structure.

8 Lectures

2. **Motivation and Information Systems:** Definition of Motivation, Importance of Motivation, Motivation and behavior, Theories of Motivation; Maslows need Hierarchy, Two- Factor Theory, McClelland 's Need Theory, Theory X and Theory Y; Information Systems: Introduction to information system in business, fundamentals of information systems, Solving business problems with information systems, Types of information systems, Effectiveness and efficiency criteria in information system.

8 Lectures

3. **Management Information Systems:** Definition of a management information system, MIS versus Data processing, MIS & Decision Support Systems, MIS & Information Resources Management, End user computing, Concept of an MIS, Structure of a Management information system; Concepts of planning & control: Concept of organizational planning, The Planning Process, Computational support for planning, Characteristics of control process, The nature of control in an organization.

8 Lectures

4. **Business applications of information technology and its management:** Internet & electronic commerce, Intranet, Extranet & Enterprise Solutions, Information System for Business Operations, Information System for Managerial Decision Support, Information System for Strategic Advantage; Enterprise & global management, Security & Ethical challenges, Planning & Implementing changes.

8 Lectures

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

References:

1. O Brian, "Introduction to Information System", MCGRAW HILL.
2. Murdick, "Information System for Modern Management", PHI.
3. Jawadekar, " Management Information System", TMH.
4. Jain Sarika, "Information System", PPM
5. Davis, "Information System", Palgrave Macmillan
6. Koontz, Weihrich, "Essentials of Management", TMH
7. K. Aswathappa, "Human Resource and Personnel Management", TMH

Paper-2: Data & File Structure Using 'C' (MCA508)

8 Lectures

1. **Introduction and Basic Data Structures:** 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.

8 Lectures

2. **Stack and Queues:** 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; Queues: Array and linked representation and implementation of queues, Operations on Queue: Create, Add, Delete, Full and Empty. Circular queue, D-queue, and Priority Queue.

8 Lectures

3 **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; Binary Search Trees: Binary Search Tree (BST), Insertion and Deletion in BST, Complexity of Search Algorithm, Path Length, AVL Trees, B-Trees; Red Black Trees, Augmenting Data Structure.

8 Lectures

4. **Searching and Sorting:** Sequential search, binary search, comparison and analysis, Hash Table, Hash Functions, Collision Resolution Strategies, Hash Table Implementation; Sorting:Two Way Merge Sort, Heap Sort, Binomial Heap, Fibonacci Heap, Mergeable heaps; Sorting on Different Keys, Practical consideration for Internal Sorting.

8 Lectures

5. **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

References

1. Horowitz and Sahani, "Fundamentals of data Structures", Galgotia
2. R. Kruse etal, "Data Structures and Program Design in C" Pearson Education
3. A M Tenenbaum etal, "Data Structures using C & C++", PHI
4. Lipschutz, "Data Structure", TMH
5. K Loudon, "Mastering Algorithms With C", Shroff Publisher & Distributors
6. Adam Drozdek, "Data Structures and Algorithms in C++", Thomson Asia
7. Pal G. Sorenson, "An Introduction to Data Structures with Application", TMH.

Paper-3: Data Base Management System (MCA509)

8 Lectures

1. **Introduction and ER Modeling:** An overview of database management system, Database System Vs File System, Database system concepts and architecture, major components of modern database system, 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.

8 Lectures

2. **Relational data Model and Language:** Data models and their use; Relational data model concepts, integrity constraints: entity integrity, referential integrity, Keys constraints, Domain constraints, relational algebra, relational calculus, tuple and domain calculus.

8 Lectures

3. **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.

8 Lectures

4. **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.

8 Lectures

5. **Transaction Processing*:*** Transaction system, Testing of serializability, Serializability of schedules, conflict & view serializable schedule, recoverability, Recovery from transaction failures, log based recovery, checkpoints, deadlock handling; 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.

References:

1 Date C J, "An Introduction To Database System", Addision Wesley
2 Korth, Silbertz, Sudarshan, "Database Concepts", McGraw Hill
3 Elmasri, Navathe, "Fundamentals Of Database Systems", Addision Wesley
4 Paul Beynon Davies, "Database Systems", Palgrave Macmillan

Paper-4: Operating Systems (MCA510)

8 Lectures

1. **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, Recent trends in OS, OS for mobile devices.

8 Lectures

2. **Process Management:** Process concept, Process scheduling techniques, Cooperating processes, Threads, Inter-process communication, CPU scheduling criteria, Scheduling algorithms, Multiple-processor scheduling, Real-time scheduling and Algorithm evaluation.

8 Lectures

3. **Process Synchronization and Deadlocks:** Resource sharing and management, 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 Lectures

4. **Storage management:** Memory Management-Logical and Physical Address Space, Swapping, Contiguous Allocation, Paging, Segmentation with paging, Virtual Memory, Page replacement algorithms, Allocation of frames, Thrashing, Page Size and other considerations, File systems, secondary Storage Structure, File concept, access methods, Efficiency and performance, Disk structure, Disk scheduling methods, Disk management, Disk structure, disk scheduling methods, Disk reliability.

8 Lectures

5 **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. File system, Networking and program interface, Linux system-design principles, Kernel Modules, Process Management, Scheduling, Memory management, File Systems, Input and Output, Inter-process communication, Network structure, security; Dynamic protection structures.

References:

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

Paper-5: Object Oriented Methodology Using C++ (MCA511)

8 Lectures

1. **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 Lectures

2. **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.

8 Lectures

3. **Functional Modeling** Functional Models, Data flow Diagrams, Specifying Operations, Constraints, a sample functional model.

8 Lectures

4. **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; Translating object oriented design into an implementation.

8 Lectures

5. **Object Oriented Methodologies:** Methodologies, examples and case studies to demonstrate methodology, comparison of Methodology, SA/SD, and JSD.

References:

1. Rambaugh James etal, "Object Oriented Design and Modeling", PHI-1997
2. Bjarne Stroustrup, "C++ Programming Language", Addison Wesley
3. Balagurusamy E, "Object Oriented Programming with C++", TMH, 2001
4. Booch Grady, "Object Oriented Analysis and Design with application 3/e", Pearson
5. Lipman, Stanley B, Jonsce Lajole, " C++ Primer Reading", AWL, 1999
6. Dillon and Lee, "Object Oriented Conceptual Modeling", New Delhi PHI-1993
7. Stephen R. Shah, "Introduction to Object Oriented Analysis and Design", TMH
8. Berzin Joseph, "Data Abstraction: the object oriented approach using C++", McGraw Hill
9. Mercer, "Computing Fundamental with C++", Palgrave Macmillan

Paper-6: Theory of Computation (MCA512)

8 Lectures

1. **Formal Languages:** Strings; Free semi-group; Languages; Generative grammars and their languages; Chomsky classification of grammars and languages.

8 Lectures

2. **Finite Automata:** Deterministic & Non-deterministic finite automata; Machines with moves on empty strings, regular expressions, Regular sets, Relationship with regular grammars, Pumping lemma for regular sets and its usage, Closure property of regular sets, Decision algorithm for regular sets, Minimization of Finite Automata.

8 Lectures

3. **Context Free Grammars:** Derivation Trees, Simplification of context free grammars, Chomsky normal form, Greibach normal form, Decision algorithm.

8 Lectures

4. **Pushdown Automata:** Instantaneous description, languages accepted my final states and empty stacks, deterministic pushdown automata, relationship with context free language.

8 Lectures

5. **Turing Machines and Undecidability:** Instantaneous description, Languages, String manipulation, Turing computability of functions, Equivalence between Turing Computability and partial recursiveness. Undecidability: Recursively enumerable and recursively decidable languages, Undecidability of decision algorithm for Type 0 grammar, Church Turing thesis, Halting problem of machine.

References:

1. Automata, Languages & Computation Hopcraft & Ullman
2. Theory of computability Hennie
3. Formal languages Revesz
4. Theory of Computer Science K L P Mishra & Chandrashekharan

Semester III:

Paper-1: Software Engineering & Case Tools (MCA513)

8 Lectures

1. **Introduction and SRS:** Introduction to software engineering, Importance of software, The evolving role of software, Software Characteristics, Maintainability sustainability of software, hardware and system design; Software engineering problems, Software Development Life Cycle, Software Process; Requirement Analysis and Specification: Analysis Principles, Water Fall Model, The Incremental Model, Prototyping, Spiral Model, Role of management in software development, Role of matrices and Measurement, Problem Analysis, Requirement specification, Monitoring and Control.

8 Lectures

2. **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 Generation Techniques; Agile methods for hardware and software design.

8 Lectures

3. **Coding and Testing:** 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.

8 Lectures

4 **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 Lectures

5. **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.

References

1. Pressman, Roger S., "Software Engineering: A Practitioner's Approach Ed. Boston: McGraw Hill, 2001
2. Jalote, Pankaj, "Software Engineering Ed.2", New Delhi: Narosa 2002
3. Schaum's Series, "Software Engineering", TMH
4. Ghezzi, Carlo and Others, "Fundamentals of Software Engineering", PHI
5. Alexis, Leon and Mathews Leon, "Fundamental of Software Engineering", Vikas
6. Sommerville, Ian, "Software Engineering", AWL, 2000
7. Fairly, "Software Engineering", New Delhi: TMH
8. Pfleerger, S, "Software Engineering", Macmillan, 1987

Paper-2: Design & Analysis of Algorithms (MCA514)

8 Lectures

1. **Introduction:** Definition of Algorithm, attributes of Algorithm, 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; brute force algorithm; to identify characteristics of an application that influences algorithm choice.

8 Lectures

2. **Different Algorithmic Concepts:** Divide and Conquer: Binary search, Strassen's matrix multiplication, Greedy Algorithm: General Approach, Knapsack Problem, Huffman Code; Number Theortic Algorithms: Factorization, GCD, Modular Arithmetic; String Matching: Naïve, Rabin-Karp, KMP Algorithms.

8 Lectures

3. **Advanced Design and Analysis Techniques:** Dynamic programming: General approach, Multistage graph, Matrix- chain multiplication, Longest common subsequence, 0/1 Knapsack problem; Backtracking: N-queen problem, Sum of subsets, Knapsack problem, Travelling salesperson problem; Branch-and-Bound: Assignment problem, 0/1 knapsack problem; Amortized Analysis.

8 Lectures

4. **Graph Algorithms:** Breadth first search, depth first search, Application of BFS, DFS: Connected component, Topological sort, Minimum Spanning Tree: Kruskal's Algorithms, Prim's Algorithms, Shortest Path: Single Source: Dijkstra, Bellman Ford; All pair shortest Path: Floyd's Algorithms, Maximum flow: Flow networks and Ford Fulkerson algorithms

8 Lectures

5**. Theory of NP-Completeness:** P, NP, NP-Complete, NP Hard, Randomized Algorithms: Randomized Quick-Sort, Randomized algorithms for n-queens, randomized min cut; Approximation Algorithms: Travelling Salesman Problem, Bin packing, Set cover, max cut; Computational Geometry: Convex Hull; Parallel Algorithms.

References

1. Horowitz Sahani, " Fundamentals of Computer Algorithms", Golgotia
2. Cormen Leiserson etal, " Introduction to Algorithms", PHI
3. Brassard Bratley, "Fundamental of Algorithms", PHI
4. M T Goodrich etal, "Algorithms Design", John Wiley
5. A V Aho etal, "The Design and analysis of Algorithms", Pearson Education

Paper-3: WEB TECHNOLOGIES USING JAVA (MCA515)

8 Lectures

1. **Introduction to object oriented programming:** Features of Java; constants, variables and data types, Operators and expressions; decision making, branching and looping; Classes, objects and Methods; arrays, strings and vectors.

8 Lectures

2. **Inheritance & File Handling:** Interfaces; Managing Input/ Output Files in Java; Packages, Exception Handling, Multithreaded Programming; Utility Classes; String Handling; Generics, Generic Class, Generic methods.

8 Lectures

3. **JDBC Overview**: JDBC implementation; Connection class; Statements; Catching Database Results, handling database Queries. Networking; InetAddress class; URL class; TCP sockets; UDP sockets.

8 Lectures

4. **Web Page Design**: Web page Designing using HTML, Scripting basics: Client side and server side scripting; Java Script-Object, names, literals, operators and expressions, statements and features, events, windows-documents, frames, data types, built-in functions, Browser object model, Verifying forms; Servlet: life cycle of a servlet; The Servlet API, Handling HTTP Request and Response, using Cookies, Session Tracking; Introduction to JSP.

8 Lectures

5. **XML**: Introduction, Displaying an XML Document, Data Interchange with an XML document, Document type definitions, Parsers using XML, Client-side usage, Server Side usage; Common Gateway Interface (CGI), PERL, RMI, COM/DCOM.

References:

1. Burdman, "Collaborative Web Development", Addison Wesley.
2. Ivan Bayross, "Web Technologies Part II", BPB Publications.
3. Margaret Levine Young, "The Complete Reference Internet", TMH
4. Naughton, Schildt, "The Complete Reference JAVA2", TMH
5. Balagurusamy E, "Programming in JAVA", TMH
6. Shishir Gundavarma, "CGI Programming on the World Wide Web", O'Reilly & Associate.

Paper-4: Computer Graphics (MCA516)

8 Lectures

1. **Introduction:** Introduction to Graphic Display Devices; Video Basics; LED & LCD Display; Flat Panel Displays; Physical Interactive Devices; Output Devices; Data Generation devices; Graphical User Interface; Raster Scan Graphics; Line, Circle & Ellipse Generation Techniques; Scan Conversion; Frame Buffer; Filling algorithms.

8 Lectures

2. **Geometrical Transformations**: Two dimensional transformations; Clipping & Windowing methods for 2D images; Three Dimensional transformations; Parallel and Perspective Projections; Viewing Transformations and Viewing Systems.

8 Lectures

3. **Plane Curves and Surfaces**: Parametric and Non-parametric curves and their representations; Cubic Splines; Bezier and B Splines.

8 Lectures

4. **Space Curves and Surfaces**: Parametric surfaces; Surfaces of revolution; Sweep surfaces; Quadric surfaces; Bilear surfaces; B Spline and Bezier Surfaces; Generalized cylinders and cones; Polygon mesh and wire frames.

8 Lectures

5. **Visible line and Visible Surfaces**: Floating Horizon algorithm; Roberts Algorithm; Warnock Algorithm; Z-Buffer Algorithm; A Buffer Algorithm; Scan Line Algorithm; Rendering; Phong reflection model, Incremental shading techniques; Gourard and Phong Shading; Illumination models; Shadows and Texture; Usage of R in Computer Graphics.

References:

1. Computer Graphics: Principles and Practice: Foley et al.
2. Computer Graphics: Hern and Baker
3. Procedural elements in Computer Graphics: David F. Rogers
4. Computer Graphics: A. Plastock and Gordon Kelley
5. Computer Graphics for IBM PC: J. Mcgregger and Alan Watt
6. Mathematical Elements for Computer Graphics: David F. Rogers and J.A.Adams

Paper-5: Numerical Methods (MCA517)

8 Lectures

1. **Floating point Arithmetic**: Numeric computation and error analysis; Representation of floating point numbers, Operations, Normalization, Pitfalls of floating point representation; Iterative Methods: Zeros of a single transcendental equation and zeros of polynomial using Bisection Method, Iteration Method, Regula-Falsi method, Newton Raphson method, Secant method, Rate of convergence of iterative methods.

8 Lectures

2. **Simultaneous Linear Equations**: Solutions of system of Linear equations, Gauss Elimination direct method and pivoting, Ill Conditioned system of equations, Refinement of solution; Gauss Seidal iterative method, Rate of Convergence.

8 Lectures

3. **Interpolation and approximation:** Finite Differences, Difference tables; Polynomial Interpolation: Newton's forward and backward formula; Central Difference Formulae: Gauss forward and backward formula, Stirling's, Bessel's, Everett's formula; Interpolation with unequal intervals: Langrange's Interpolation, Newton Divided difference formula, Hermite's Interpolation Approximation of function by Taylor's series and Chebyshev polynomial.

8 Lectures

4. **Numerical Differentiation and Integration**: Introduction, Numerical Differentiation, Numerical Integration, Trapezoidal rule, Simpson's rules, Boole's Rule, Weddle's Rule Euler- Maclaurin Formula; Solution of differential equations: Picard's Method, Euler's Method, Taylor's Method, Runge-Kutta methods, Predictor-corrector method, Automatic error monitoring, stability of solution.

8 Lectures

5. **Curve fitting, Cubic Spline and Approximation**: Method of least squares, fitting of straight lines, polynomials, exponential curves etc; Frequency Chart: Different frequency chart like Histogram, Frequency curve, Pi-chart; Regression analysis: Linear and Non-linear regression, Multiple regression; Time series and forecasting: Moving averages, smoothening of curves, forecasting models and methods; Statistical Quality Controls methods.

References :

1. Hopcroft, Sethi and Ullman, Compiler Principles, AddisonWesley
2. John Levine, Linkers and Loaders, http://www.iecc.com
3. info lex and info bison on GNU/Linux Systems
4. H. Abelson and G. Sussmann, Structure and Interpretation of Computer Programs, MIT Press

5. Hopcroft and Ullman, Introduction to Automata theory, Languages and Computation, Narosa Pub.
6. Systems Programming & Operating Systems- D M Dhamdhere THM

Paper-6: Advanced Computer Architecture (MCA518)

8 Lectures

1. **Computer Architecture:** Difference between scalar, scalar pipeline, scalar superpipeline and superscalar architecture; Pipelining Processing: An overlapped parallelism, Instruction and Arithmetic pipelines; Comparative study of 16 bit and 32 bit processor families; Basics of Pentium Processors; Comparative study of Microcontrollers; Future Trends; Instruction set architecture; role of Amdahl's law.

8 Lectures

2. **Parallel Computing Concepts:** Introduction to Parallel computing; Parallelism in Uni-processor Systems, Parallel computer Structures, Architectural Classification schemes, parallel processing applications; Case studies of vector processors, Array processors, Cube, Hypercube, Parallel algorithms on hyper cubes, Multiprocessor system, Multiprocessor interfacing schemes, Tightly & loosely coupled systems.

8 Lectures

3. **Array and Vector Processing:** Principles of designing pipelined processors, Internal forwarding and register tagging, Hazard detection and resolution, Job sequencing and collision prevention, Concept of Array and Vector processing, Masking and Data routing: Concurrency in Pipelining and Vector Processing; Cache Coherence.

8 Lectures

4. **Improved Architectures:** Concept of RISC systems; Data flow architectures; Comparison with control flow systems, Shuffle exchange and Omega Network, VLIW Architecture; EPIC Architecture.

8 Lectures

5. **Introduction to Parallel Algorithms:** Addition on Tree, Cube, Mesh, Linear Array, PSN, etc. Matrix multiplication on Mesh, Cube, Torus, etc.; Parallel Sorting; Associative Processing.

References:

1. Computer Architecture & Parallel processing – Hwang & Briggs
2. Computer Architecture – Jean Loop Bear
3. Introduction to Distributed and Parallel computing- Crichlow
4. Designing Efficient Algorithms for parallel Computers- M.J.Quinn
5. Introduction to Parallel Algorithms- Joseph JA
6. The Design and Analysis of Parallel Algorithms- S.G.Akl
7. Computer Architecture & Organization – B Govindrajalu TMH

Semester IV:

Paper-1: .Net Framework & C# (MCA519)

8 Lectures

1. **The .NET framework**: Introduction, Common Language Runtime, Common Type System, Common Language Specification, The Base Class Library, The .NET class library Intermediate language, Just-in-Time compilation, garbage collection, Application installation & Assemblies, Web Services, Unified classes.

8 Lectures

2. **C# Basics: Introduction:** Data Types, Identifiers, variables & constants, C# statements, Object Oriented Concept, Object and Classes, Arrays and Strings, System Collections, Delegates and Events, Indexes Attributes, versioning.

8 Lectures

3. **C# Using Libraries**: Namespace-System, Input Output, Multi-Threading, Networking and Sockets, Data Handling, Windows Forms.

8 Lectures

4. **Web Application:** C# in Web application, Error Handling.

8 Lectures

5. **Advanced Features Using C#:** Introduction to ASP. NET, Web Services, Windows services, messaging, Reflection, COM and C#, Localization; Advanced Features Using C#: Distributed Application in C#, XML and C#, Unsafe Mode, Graphical Device Interface with C#, Case Study (Messenger Application).

References:

1. Jeffrey Richter, "Applied Microsoft .Net Framework Programming", (Microsoft)
2. Fergal Grimes, "Microsoft .Net for Programmers", (SPD)
3. TonyBaer, Jan D. Narkiewicz, Kent Tegels, Chandu Thota, Neil Whitlow, "Understanding the **.**Net Framework", (SPD)
4. Balagurusamy, "Programming with C#", TMH

5. Herbert Schildt, " C# 4.0 The Complete Reference "

Paper-2: Multimedia Systems (MCA520)

8 Lectures

1. **Multimedia Technology**: Meaning & scope of Multimedia; Elements of Multimedia; Creating multimedia applications; Multimedia file & I/O functions; Multimedia data structures; Multimedia file formats; Multimedia Protocols.

8 Lectures

2. **Multimedia audio**: Digital sound; Audio compression & decompression; Companding; ADPCM compression; MPEG audio compression; Special effects and Digital Signal Processing; Audio synthesis; FM synthesis; Sound blaster card; Special effect processors on sound cards; Wave table synthesis; MIDI functions; Speech synthesis & Recognition.

8 Lectures

3. **Multimedia Video:** Representation of Digital video; Video capture; Frame grabbing; Full motion video; Live video in a window; Video processor; Video compression & decompression; Standards for video compression & decompression; Playback acceleration methods.

8 Lectures

4. **Creating Multimedia Animation and Authoring Tools:** Icon animation; Bit-map animation; Real-time vs Frame by Frame animation; Object modeling in 3D animation; Motion control in 3D animation; Transparency; Texture, Shadows, Anti-aliasing; Human modeling & Animation; Automatic motion control; Multimedia Authoring tools: Project editor; Topic editor; Hot-spot editor; Developing a multimedia title; Multimedia text authoring systems; Usage of authoring tools.

8 Lectures

5. **Multimedia communication systems:** Multimedia DBMS; Documents, Hypertext and MHEG; User Interfaces; Synchronization, A reference model for multimedia synchronization; Multimedia on LANs & Internet: Multimedia on LAN; Fast modems & Digital networks for multimedia; High speed digital networks; Video conferencing techniques; Multimedia interactive applications on internet; Future Directions.

References:

1. Multimedia: Computing, Communications & Applications – Nahrstedt & Steinmetz
2. Computer Speech Processing – Fallside F.
3. Speech Analysis, Synthesis & Perception – Flanagan,J.L.
4. Hypertext & Hypermedia- Nielsen J.
5. Digital Processing of Speech Signala- Rabiner L.R. & Schafer L.W.

Paper-3: Embedded Systems (MCA521)

8 Lectures

1. **Introduction:** Embedded System: History & Overview; Structure of an Embedded System- Hardware Component/ Software Component; Classification of Embedded System; Design Constraints: Functionality, Cost, Performance, Power and Energy, Time to Market, Reliability & Maintainability; Real Time System Vs Non-real Time System; I/O methods, Introduction to Interrupts; I/O & CPU interaction; Scheduling methods for Real-Time Systems; I/O Resources & architecture; Memory- capacity & allocation; Multi-resource services – Priority Inversion Problem, Priority Inheritance.

8 Lectures

2. **Embedded Programming**: Assembly Language Programming; Macros; Modular and Interrupt driven programming; Interrupts and ISR; Embedded Programming using C; Java, C++, J2ME; Mixing C and Assembly code; Priority handling; Bootstrap Sequence; Timers and Event Counters.

8 Lectures

3. **Embedded System Components**: Hardware Components: Op-Amp, FPGA, Sensors, Actuators, A/D converters, I/O interfaces- UART/USART, PPI, USB, Bluetooth, Infrared, Ethernet; Processor & I/O interconnection; Firmware components; Real-Time OS System software mechanism – Message Queues, Binary Semaphores, Mutex, Messages, Pipe; Software application components; Debugging components.

8 Lectures

4. **External World Interfaces**: General purpose I/O ports; Interfacing External devices to GPIO; Interfacing Switch & Switch arrays; Interfacing display devices; Interfacing LEDs & LCDs; Motor interfacing; Managing DC/AC loads and voltages; RFID and its applications; Managing Embedded System Development Projects, mobile and network embedded systems.

8 Lectures

5. **DSP Based Embedded System Design**: Overview of DSP: Analog Signal Processing, Digital Signal Processing, Advantages of Digital Signal Processing, Types of Signals; Need for DSP based Embedded Systems; Digital Signal Processing System; Sampling Theorem; Time Domain analysis of Digital System; Frequency domain analysis of signals; Applications of DSP; DSP architecture; DSP based Embedded System design process; Future Trends – Emerging Technologies; Pervasive/Ubiquitous Computing; Security of

Embedded System; Embedding Intelligence; Some Embedded Applications – Robotics applications, Continuous Media application, Computer Vision application.

References:

1. Automatic Control Systems - Kuo, B.C.
2. Real-time Computer Control - Linkens & Bennett
3. Real-time software for small systems - leigh, A.W.
4. Programming embedded microprocessors - Fowler, R.J.
5. Real-time systems Design & Analysis - Laplante P.A.

Paper-4: Operational Research (MCA522)

8 Lectures

1. **Network Analysis:** Terminology of network, Shortest route problem, minimal spanning tree problem, max-flow problem.

8 Lectures

2. **Project Scheduling by PERT, CPM:** Diagram, representation, critical path calculation, construction of time chart and resource labelling, probability and cost consideration in project scheduling, project control.

8 Lectures

3. **Linear and Nonlinear Programming:** Simplex Method, Revised simplex method, Duality in Linear programming, Application of Linear Programming to Economic and Industrial Problems; Nonlinear Programming: The Kuhn-Tucker conditions, Quadratic programming, Convex programming.

8 Lectures

4. **Replacement Models:** Introduction, Replacement policies for items whose efficiency deteriorates with time, Replacement policies for items that fail completely.

8 Lectures

5. **Sequencing Model:** Classification of self problems, processing of n jobs through two machines, three machines, processing of two jobs through 'm' machines.

References:

(1) Taha, Operations Research, Macmillan.
(2) B.E. Gillet, Introduction to Operations Research, McGraw-Hill.
(3) S.S.Rao, Optimization Theory and Applications, Wiley Eastern.
(4) G.Hadley, Linear programming, Addison-Wesley.

Paper-5: System Programming (MCA523)

8 Lectures

1. **Basics Of System Software And Assembler**: Introduction; System software and SIC/XE machine architecture; Basic assembler functions; Assembler algorithms and data structures; Machine dependent assembler features, Instruction formats and addressing modes; Program relocation; Machine independent assembler features; Literals; Symbol-defining statements; Expressions; Program Blocks; Control Sections and Program Linking-Implementation examples MASM assembler.

8 Lectures

2. **Compiler- Lexical Analysis, Syntax Analysis**: Principle of compiler system; Phases of compiler-Lexical Analysis: Role of a Lexical analyzer, input buffering, specification and recognition of tokens, Finite Automata, Designing a lexical analyzer generator, Pattern matching based on NFA's; Syntax Analysis: Role of Parser, Top-down parsing, recursive descent and predictive parsers (LL), Bottom-Up parsing, Operator precedence parsing, LR, SLR and LALR parsers.

8 Lectures

3. **Compiler- Code Generation, Optimization**: Intermediate languages: graphical representations, DAGs, Three address code, types of three address statements, syntax directed translation into three address code, implementation of three address statements-Code Optimization: Machine dependent and machine independent code generation: Sources of optimization-Code Generation-Semantic stacks, evaluation of expressions, control structures, and procedure calls.

8 Lectures

4. **Loaders And Linkers**: Basic loader functions: Design of an Absolute Loader; A Simple Bootstrap Loader Machine dependent loader features Relocation; Program Linking; Algorithm and Data Structures for Linking Loader; Machine-independent loader features; Automatic Library Search; Loader Options Loader design options; Linkage Editors; Dynamic Linking; Bootstrap Loaders; Implementation examples: MSDOS linker.

8 Lectures

5. **Macro Processors & Other System Software**: Basic macro processor functions; Macro Definition and Expansion; Macro Processor Algorithm and data structures; Implementation examples: MASM Macro

Processor- Text editors; Overview of Editing Process; User Interface; Editor Structure; Interactive Debugging Systems; Debugging functions and capabilities; Relationships with Other parts of the system; User Interface Criteria; Virtual Machines.

References:

1 Distributed Operating Systems: A.S.Tanenbaum
2 Distributed Systems Concepts and Design: G.F.Coulouris, J.Dollimore and T.Kindberg
3 Distributed Operating Systems: Pradeep K. Sinha

Paper-6: Data Communication & Networks (MCA524)

8 Lectures

1. **Data Communication Basics:** Bandwidth & Data Rate; Properties of a Channel; Source encoding & Channel encoding; Analog & Digital Signaling; Analog & Digital Transmission; Modulation; Multiplexing; Error Detection & Correction; Switching Techniques; Importance of Nyquist Criterion; Shannon's Sampling Theorem; History of Computer Networks.

8 Lectures

2. **Introduction to Networks**: Advantages & Disadvantages; Classification of Computer Networks; Evolution of LAN; Evolution of WAN; Classification of Medium in Wired & Wireless environment; Types of error in Computer Networks; Network Protocols & their role; Network Topology; Introduction to IoT.

8 Lectures

3. **Network Devices and Routing**: PSTN; Hub, Switch, Bridge, Router and Gateway; Layered approach to Network Design; ISO/OSI model; TCP/IP model; MAC addressing; Routing Techniques: Link State/ Distance Vector; Network Design; IP addressing: IPv4 VS IPv6; Subnetting; Reasons for subnetting; CIDR.

8 Lectures

4. **Internet & its Services**: HTTP; Web Server & its configuration; File Transfer Service; E-mail Service; Network Security – Network attacks and Security issues; Network Security Technologies – IDS, IPSec, RADIUS, SSH, SSL; Wi-Fi Protected access; Network firewalls – Firewall types, Firewall rules, Firewall architecture; Network Resource Management.

8 Lectures

5. **Wireless Networks**: Wireless Network Technologies – IEEE 802.3 Ethernet, IEEE Wireless LAN Standard 802.11, WiMax (802.16), Wireless PAN (802.15), Infrared, Bluetooth; Interference between Bluetooth and 802.11, Ultra-wide band Wireless PAN, Zigbee; Introduction to AdHoc Networks; Introduction to Wireless Sensor Networks; Introduction to Cellular Networks.

References:

1. Data and Computer Communication- W.Stallings,
2. Computer Networks- A.S.Tanenbaum
3. Computer Network and Distributed Data Processing- J. Martin
4. Local Networks - W.Stallings
5. Computer Communication Network Design and Analysis- M.Schwertz
6. Data Communications and Networking- B. A. Forouzan
7. TCP/IP fundamentals-Vol I & II - Comer

Semester V:

Paper-1: Image Processing (MCA525)

8 Lectures

1. **Introduction:** Image representation and modeling, 2-D linear system, Luminance, Contrast and Brightness, Color representation, Visibility functions, Monochrome and color vision model.

8 Lectures

2. **Image Quantization and Image Transforms:** Sampling theorem, Anti-aliasing, image quantization, Orthogonal and unitary transforms, DFT, Cosine transform, Hadamard transform, Haar transform, KL transform.

8 Lectures

3. **Image Enhancement:** Point operation, Histogram modeling, Filtering and spatial operations, Transform operations, Multi-spectral Image Enhancement

8 Lectures

4. **Image Restoration:** Image formation models, Noise models, Inverse and Wiener filtering, Least square filters, Recursive filters, Maximum entropy method, Blind de-convolution, Bayesian method of noise removal, Image reconstruction, Tomography, Radan transform, Back-projection, Reconstruction algorithm, Algebraic method of reconstruction, Fan-beam reconstruction.

8 Lectures

5. **Data Compression:** Data compression vs. Bandwidth, Pixel coding, Predictive coding, Transform coding, Coding of two-tone images.

References:

1. Fundamentals of Digital Image Processing: Anil K. Jain
2. Digital Image Processing: R. Chellappa
3. Image Processing for Scientific Applications: Bernd Jahne
4. Digital Image Processing: R.C. Gonzalez & R.E. Woods
5. The Image Processing Handbook: J.C. Russ
6. Digital Image Processing: W.K. Pratt
7. Digital Image Restoration: Andrews & Hunt

Paper-2: Information Retrieval & Web Mining (MCA526)

8 Lectures

1. **Introduction and Information Retrieval Models:** Role of data mining in computer engineering application; role of machine learning in computer engineering; Introduction to information storage and retrieval, IR models, functional view of paradigm IR system, IR and other types of information systems; IR evaluation: Measuring effectiveness of IR system; Precision and recall, User centered evaluation. Boolean model, Vector space model, Probabilistic model, non-classical models of IR – Information logic model, cluster model, LSI model; AI in IR – ANN model, genetic algorithm model, Knowledge-bases, Natural language processing; Query expansion.

8 Lectures

2. **Data structures and algorithms related to IR**: Data visualization; Data structures -inverted files and its implementation, B-trees and tries, signature files; algorithms – indexing and retrieval algorithms.

8 Lectures

3. **Term and query operation:** Tokenization, stop lists, stemming, different types of stemmers; thesaurus construction; query modification.

8 Lectures

4. **Vector space model:** Indexing - document and query representation; Term weighting; Similarity measures, ranking algorithms; Query expansion- Relevance feedback methodology Rocchio's and Ide's method, Evaluation of relevance feedback; clustering algorithms and its application.

8 Lectures

5. **Further topics:** Web information indexing; Web Information categorization and ranking; Web IR evaluation; Data fusion, Text mining; Semantic Web; Intelligent agents in IR.

References:

1. Modern Information Retrieval, Ricardo – Baeza Yates, B. Ribeiro-Neto (Addison Wesley Longman)
2. C. J. van Rijsbergen "Information Retrieval", Second Edition
3. G. Salton, and M. J. McGill, "Introduction to modern information retrieval". New York: McGraw-Hill
4. Information Retrieval: Data Structures and algorithms. W. Frakes and R. Baeza-Yates (Eds.). Prentice Hall
5. Introduction to Information Retrieval, by C. Manning, P. Raghavan, and H. Schütze

Paper-3: Artificial Intelligence (MCA527)

8 Lectures

1. **Introduction:** What is AI?; Scope of AI: Games, theorem proving, Natural language processing, Vision and speech processing, Robotics & Expert systems, AI techniques, Introduction to intelligent agents.

8 Lectures

2. **Search Techniques:** State space search, control strategies: Depth first search, Breadth first search and Production systems; Use of heuristics: Hill climbing, Best first search, A* algorithm- admissibility, AND/OR graph – AO*, Constraint satisfaction; Game playing: Minimax and Alpha-Beta searching, Genetic algorithms.

8 Lectures

3. **Knowledge Representation:** Propositional logic: its syntax and semantics; Reasoning patterns in propositional logic: Resolution, forward and backward reasoning; First order logic: Syntax and semantics; Inference in first order logic: Unification, Forward & backward chaining, Resolution; Structured knowledge representation: Semantic Net, Frames, and Conceptual graphs.

8 Lectures

4. **Uncertain knowledge and reasoning**: Introduction to probabilistic reasoning; representing vagueness- fuzzy sets and fuzzy logic.

8 Lectures

5. **Learning:** Different forms of learning; Concept learning system; Inductive learning; Learning decision trees; Neural network: single layer feed forward network.

References:

1. Artificial Intelligence: Rich and Knight
2 .Artificial Intelligence: A Modern Approach: Stuart Russell and Peter Norvig
3 .Introduction to Artificial Intelligence: Partick Winston

4 .Artificial Intelligence: Nilsson

Paper-4: Digital Communication (MCA528)

8 Lectures

1. **Basic of Digital Communication:** Analog vas Digital communication; elements of digital communication system; history; communication channels and their characteristics; classification of signals: deterministic and random signals, periodic and a-periodic signals, analog and discrete signals, energy and power signals, unit impulse functions, random signals and processes; bandwidth of digital data; noise in communication systems; importance of Nyquist criteria; need for using transform and how they differ for analog and discrete time signals.

8 Lectures

2. **Baseband Modulation and Demodulation:** Baseband systems; sampling theorem; sources of corruption; sampling and quantization effects; channel effects; signal to noise ratio for quantized pulses; pulse code modulation; uniform and non-uniform quantization; baseband transmission; demodulation and detection; detection of binary signals in Gaussian noise; equalization; pulse stuffing; differential PCM; delta modulation; adaptive delta modulation.

8 Lectures

3. **Band Pass Modulation and Demodulation:** Digital bandpass modulation techniques: ASK, FSK, PSK, BPSK, DPSK, QPSK; detection of signals in Gaussian noise; M-ary signaling and performance.

8 Lectures

4. **Source and Channel Coding:** Mathematical models for information; average mutual information and entropy; coding for discrete sources; coding for analog sources; channel capacity and coding; waveform coding; linear block codes; cyclic codes; some well known block codes likes Hamming codes, extended Golay codes, BCH codes; convolutional encoding; properties of convolutional codes; transform coding.

8 Lectures

5. **Multiuser Communication:** Multiplexing and multiples access: FDMA, TDMA, CDMA, SDMA; multiple access communication system and architecture; access algorithms: ALOHA, Slotted ALOHA, Reservation ALOHA and Polling techniques; multiple access techniques for LAN; multiple access techniques employed with IntelSAT; introduction to spread spectrum techniques and its advantages.

References:

1. Principles of Communication, Taube Schilling (TMH)
2. Digital Communication, J.G. Proakis (TMH)
3. Digital Communication, S.Haykin (Wiley)
4. Digital Communication, Sklar & Ray (Pearson)

Paper-5: Secure Computing (MCA529)

8 Lectures

1. **Basics of computer security:** Kinds of security branches, Security goals and vulnerabilities, Methods of Defence; Data security and integrity; vulnerabilities and exploitation; wired and wireless network security protocols.

8 Lectures

2. **Program Security:** Viruses and other malicious codes, Targeted malicious codes, Controls against program threats; Protection in General purpose operating systems, Protecting memory and addressing, Protecting access to general objects, File protection mechanisms, User authentication

8 Lectures

3. **Security in Networks and Distributed Systems:** Threats in Network, Network security control, Administering Security; web security; network management.

8 Lectures

4. **Encryption and Decryption:** Secret and public key cryptography; Mono alphabetic substitution ciphers, Poly alphabetic substitution ciphers, Transpositions, Stream and block ciphers, Secure encryption system: Public key Encryption, Merkel Hellman, knapsacks, RSA Encryption, EL Gamel algorithm, Hash Algorithms, Digital Signature algorithm, Symmetric system, DES algorithm, Enhancing cryptographic security.

8 Lectures

5. **Legal and Ethical issues in Computer Security:** Protecting programs and data, computer crime, Ethical issues, Electronic privacy; trusted computing.

References:

1. Security in computing — Charles P.Pfleeger (Prentice Hall)
2. Computer Security Handbook Vol 1 & 2 — Bosworth, Kabay & Whyne (Wiley)
3. Applied cryptography — Schneier, Bruce (Wiley)
4. Practical cryptography — Schneier & Ferguson (Wiley)
5. Introduction to cryptography: Principles and applications — Delfs & Knebl (Springer)

Semester VI:

Paper-1: Mobile Computing & Applications (MCA530)

8 Lectures

1. **Introduction:** Evolution and fundamentals of Mobile communication, Terminal mobility, Personal Mobility and Service Portability, The Cellular concept, A basic cellular system, Multiple access technologies of cellular systems, Analog & Digital cellular systems, Generations of systems, Cellular system operation and planning, System architecture, Location updating and call setup, Handoff & power control

8 Lectures

2. **Digital cellular systems:** Evolution of Mobile System, GSM, GSM standardization and service aspects, GSM reference architecture and function partitioning, GSM radio aspects, GSM security aspects, GSM protocol model, GSM call flow sequences, gprs, edge; (Wireless) Medium Access Control: Motivation for a specialized MAC (Hidden and exposed terminals, Near and Far terminals), SDMA, FDMA, TDMA, CDMA

8 Lectures

3. **Mobile network and transport layer:** Mobile IP: goals, assumptions, entities and terminology, IP packet delivery, agent advertisement and discovery, registration, tunneling and encapsulation, optimizations, Dynamic Host Configuration Protocol (DHCP); Mobile Transport Layer: Traditional TCP, Indirect TCP, Snooping TCP, Mobile TCP, Fast retransmit/fast recovery, Transmission/ time-out freezing, Selective retransmission, Transaction oriented TCP

8 Lectures

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

8 Lectures

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

References:

1. Mobile and Personal communication systems and Services – Raj Pandya
2. Mobile Communications – Schiller J.
3. Mobile Cellular Telecommunications – Lee William C.Y.
4. Wireless Communications & Networks – Stallings, William

Paper-2: Elective: Cloud Computing, E-commerce & Cyber laws/ High Performance Computing/Human Computer Interaction/ Application Development on Hand-held devices/ Computer Animation/Natural Language Processing/Computer Vision/Artificial Neural Networks/Fuzzy Systems (MCA-602)

Application Development on Hand Held Device (MCA531)

8 Lectures

1. **Introduction To Application Development for Handheld:** Features, Device Types, Device Limitations, Technology & marketing trends, Mobile Applications and its Types, Mobile web sites, Apps, Web apps and Native Apps, Introduction to Mobile Web design, Design Time and Runtime Considerations.

8 Lectures

2. **Website Design For Smart Devices:** HTML5, Javascript, Jquery Programming, Jquery Selectors, Event Binding, Animation, Ajax, CSS3 Features for web, border-radius, gradients, box-sizing, min-width, max-width, box-shadow, text-shadow, text-overflow, multiple-backgrounds, Understanding CSS Animations, Using CSS Transitions, Css Media Queries, Role of Mordenizer.Js, Responsive Website Design and Development, Firebug Extension, Layout Frameworks, Using Skeleton.js.

8 Lectures

3. **Web Apps:** Jquery Mobile, Introduction, Data Attributes, Pages, Dialog, Toolbars, Navbars, Theming, Transitions, Ajax, Events, Touch, Swap, Tap, Slide, Offline Cache, Customizing Themes, Deployment.

8 Lectures

4. **Development of WebApp:** Web App as Native Android Introduction, Developer Tools, Platform Tools, ADB, AVD, Phonegap/ Cordova Introduction, Development Environment, CLI and Build, Converion to Native for platforms (android/windows/ios etc.), Deployment, Geolocation, Device Rotation, Device Orientation, Touch gestures, Offline Apps, Client Side storage, Testing and Deployment on virtual and physical devices.

8 Lectures

5. **Development of Native App:** Native App, Android Studio, Getting Started with IDE, Development, Debugging and Deployment, Programming Model and Structure, APIs and Packages, Accessing native services of OS, Testing and Deployment on virtual and physical device.

References:

1. Build Mobile Websites And Apps for Smart Devices by E. Castledine
2. Jump Start Responsive Web Design by Craig Sharkie & Andrew Fisher
3. O'REILLY Building Android Apps with HTML, CSS and Javascript
4. Beginning Android 4 Application Development by Wei-Meng Lee

Distributed Computing

8 Lectures

1. **Introduction to Distributed Systems:** Goals and advantages of distributed systems, Distributed Computing System Models, Network operating systems, True distributed systems, Design issues – Transparency, Reliability, Performance and Scalability.Message Passing, Group communication.

8 Lectures

2. **RPCs and Distributed Shared Memory:** Remote procedure call (RPC), Light Weight RPC, Client Server Communication. Introduction to shared memory, Comparison of shared memory systems, Consistency models, Page-based distributed shared memory.

8 Lectures

3. **Synchronization in Distributed Systems:** Clock synchronization, Logical and physical clocks, Vector clock, Clock synchronization algorithms, Mutual exclusion – Centralized, Distributed, Token Ring and Maekawa's Algorithm*,* Election Algorithms*,* Atomic transactions, Deadlocks in distributed systems.

8 Lectures

4. **Processes and Processors in Distributed Systems:**Process Migration*,* Threads – Usage, Design issue and implementation, Scheduling in distributed systems, Load balancing and Load sharing, Fault tolerance.

8 Lectures

5. **Distributed File Systems and Security :** File Models, File Accessing Models, File Sharing Semantics, File Caching Schemes, File Replication.Security in Distributed System: Potential Attacks to Computer Systems, Introduction to Cryptography, Authentication, Access Contro. Case Studies: V -Systems, Amoeba,

E-COMMERCE & CYBER LAWS

5 Lectures

1. **Introduction:** Electronic Commerce - Technology and Prospects, Definition of E- Commerce, Economic potential of electronic commerce, Incentives for engaging in electronic commerce, forces behind E-Commerce, Advantages and Disadvantages, Architectural framework, Impact of E-commerce on business.

6 Lectures

2. **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).

5 Lectures

3. **Mobile Commerce:** Introduction, Wireless Application Protocol, WAP technology, Mobile Information device, Mobile Computing Applications.

5 Lectures

4. **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.

8 Lectures

5. **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.

5 Lectures

6. **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.

6 Lectures

7. **Cyber Laws**

References

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

HIGH PERFORMANCE COMPUTING

5 Lectures

Introduction:

Motivation for high performance and parallelism application areas, Technologies, Abstraction levels, Models of Computation; Overheads, Multiple program counters, Multi-threaded execution models; Parallel languages and compilers, Task Parallel and Data parallel Programming models; Memory architecture; Memory access times and associated overheads; Performance timing; Restructuring for parallel performance; Parallelising compilers; Load & Data transformation; State of the art research & future direction

5 Lectures

Microprocessor and system architecture:
Pipelining, superscalar designs; SIMD, multithreading; caches; memory, busses; Asynchronous microprocessors for high performance processing and low power applications

5 Lectures

Multi processor architectures:
Classification; programming models; application examples; interconnection networks

5 Lectures

Tightly coupled systems:
Cache coherence, consistency, synchronization; SMP, ccNUMA, COMA; performance evaluations

20 Lectures

Other architectures and extensions:

Distributed memory systems; vector systems; clusters, grids
Supercomputer Architecture; Vector Machines; Parallel Processors; Data Parallel Processors. Single-Instruction-Multiple-Data; Multiple-Instruction-Multiple-Data; Pipelining; Vectorization; Parallelization; Superscalar execution – VLIW computation; PRAMs – parallelism issues
Comparison of Serial, Parallel and Vector Architectures.
Performance Measures and Models; Speed-up limitations; Theoretical Timings; Efficiencies; Amdahl's Law and Extensions; Scaled Speed-up; Pipeline Speed-up.
Data Dependency Reduction. Data flow; Loop reordering.
Parallelization of Algorithms; Parallel linear algebra routines; Loop optimizations; Implementation; Principle of Locality; Caches and Buffers.

References:

1. J. J. Dongarra, I. B. Duff, D. C. Sorensen and H. A. van der Vorst: Solving Linear Systems on Vector and Shared Memory Computers, SIAM, 1991.
2. K. Hwang: Advanced Computer Architecture: Parallelism, Scalability, Programmability, McGraw-Hill
3. D. A. Patterson and J. L. Hennessy, Computer Architecture: A Quantitative Approach, Morgan Kaufmann
4. D. Kuck: The Structure of Computers and Computations, Wiley
5. Levesque and Williamson: A Guidebook to FORTRAN on Supercomputers, Academic Press
6. Metcalf: FORTRAN Optimization, Academic Press
7. J. M. Ortega: Introduction to Parallel and Vector Solution of Linear Systems, Plenum
8. Quinn: Designing Efficient Algorithms for Parallel Computers, McGraw-Hill
9. P. J. Hatcher and M. J. Quinn: Data-Parallel Programming on MIMD Computers, MIT Press
10. Parallel processor architecture & VLSI Hardware: Decegama A.L.
11. Introduction to Parallel Algorithms & Architectures – Arrays, Trees and Hypercubes: Leighton F. Thomson

Computer Vision

5 Lectures

Images:
Sources of imagery, The physics of imaging, Representing, acquiring, and displaying images, Grayscale, color, noise, lens distortion, and filtering

5 Lectures

Image processing:
Preprocessing, and image correction, Enhancing features and correcting imperfections, Addressing noise, lens distortion, and blurring.

5 Lectures

Computer Vision Paradigms:
Bottom-up, top-down, neural net, feedback, Pixels, lines, boundaries, regions, and object representations, "Low-level", "intermediate-level", and "high-level" vision, Historical and illustrative examples.

5 Lectures

Finding Edges and Lines:
Finding edges (low-level), Gradients, zero crossing detectors, line models, Roberts, Sobel, Cany, Finding and grouping lines (intermediate-level), Boundary tracing, line fitting, Hough transform.

15 Lectures

Finding and Processing Regions:
Finding "elementary regions" (low-level), Merging, splitting, and grouping regions (intermediate-level)
Grouping and analyzing lines and regions (high-level), Guzman, Clowes and Huffman, Waltz.
Stereo, and Motion, Optical Flow and FOE, Motion Understanding

Texture, Fourier transform
Representing the environment and Matching, Clouds, generalized cylinders, semantic nets, Matching line and region groups to object representations (high-level).

5 Lectures

Applications:
Using computer vision, Applications in Medicine, Industry, and Surveillance

References:

1. Digital Image Processing - R.C.Gonzalez & P.Wintz
2. Computer Vision - D.H.Ballard & C.M.Brown
3. Syntactic Pattern Recognition: An introduction -R.C.Gonzalez and M.G.Thomason
4. Pattern Recognition - A Statistical Approach - P.A. Devijver and J. Kittler
5. Digital Image Processing - W. K. Pratt
6. Fundamentals of Digital Image Processing - A.K. Jain
7 Digital Picture Processing - A. Rosenfeld and A.C. Kak
8. Vision in Man and Machine - M.D. Levine

Artificial Neural Networks

5 Lectures

Introduction:
Real and artificial neural networks, Neurons as Processing elements, Activation and Signals, Threshold functions, Connection topologies.

15 Lectures

Network Models:
Dynamical Systems viewpoint, Additive dynamics, Additive neuronal feedback, Bivalent additive associative memory, Stability of BAMs, Lyapunov functions, Bivalent BAM theorem, BAM connection matrices, Linear associative memory, Optimal linear associative memory, Memory capacity, Hopfield model,
Additive dynamics and Noise-Saturation dilemma, Grossberg's saturation theorem, Multiplicative dynamics, Shunting inhibition, Adaptive resonance theory of Grossberg, ART1 and ART2 networks.

20 Lectures

Network Learning Methods:
Unsupervised learning, Learning laws, Signal Hebbian, Competitive, Differential Hebbian and differential competitive learning laws, Deterministic and stochastic learning, Stochastic equilibrium, Asymptotic centroid estimation, Kohonen's self-organizing map, Reinforcement learning.
Supervised learning, Stochastic approximation, Perceptron learning theorem, LMS algorithm, Back-propagation algorithm, Multilayer feed-forward networks, Enhancements in Back-propagation algorithm., Recurrent back-propagation.

Adaptive vector quantization, AVQ algorithms, Convergence theorem, Adaptive bi-directional associative memory.

References:

1. Neural Networks and Fuzzy Systems: Bart Kosko
2. Neural Computing: Theory and Practice: P.D.Wasserman
3. Artificial Neural systems: P.K.Simpson
4. Neurocomputing: Robert Hecht-Nielson
5. Neural Networks: J.A.Freeman

Fuzzy Systems

8 Lectures

Fuzzy Set Concepts
Fuzzy and crisp sets, Operations on Fuzzy sets, Extended Fuzzy sets, Fuzzy quantifiers and its relation to linguistic variables, members function and its estimation, binary and n-ary fuzzy relations, fuzzy graphs and matrices.

8 Lectures

Fuzzy Measure
Belief and plausibility measures, probability measure, possibility measures,

8 Lectures

Theory of Approximate reasoning and uncertainty measurement
Multivalent logic and fuzzy valued logic, fuzzy model logic, approximate reasoning, fuzzy algebra and uncertainty, classical and fuzzy measures of uncertainty

8 Lectures

Fuzzy Systems

General fuzzy systems and its design, fuzzy control systems with applications, fuzzy optimization, fuzzy expert and decision Making systems, probabilistic search trees, fuzzy pattern analysis, fuzzy database search, some applications

8 Lectures

Fuzzy Programming and Tools

Fuzzy Programming environments, efficiency and accuracy, fuzzy tools, learning fuzzy rules in neural networks, fuzzy associative mapping, introduction to neuro-fuzzy and fuzzy genetic approaches.

Reference:

1. Fuzzy mathematical techniques with application: Abraham Kandel
2. Fuzzy Sets, Uncertainty and information: G.J. Klir and T.A. Folger
3. Fuzzy Systems: C.v. Negotia
4. Neural Networks and Fuzzy Systems: B. Kosko