Semester Based Course Structure FOR
Master of Science (Computer Science) Program (w.e.f. July 2020-21)
School of Science, UPRTOU, Prayagraj

Semester	Course Code		Title of the Course	Max. Marks	Credits
First	MCS-101		Discrete Mathematics	100	4
	MCS-102		C++ and Object oriented programming	100	4
	MCS-103		Data Structures	100	4
	MCS-104		Software Engineering	100	4
	MCS-105(P)		Practical Work (Based on 102 & 103)	100	2
Credit of I semester				**500**	**18**
Second	MCS-106		Computer Organization	100	4
	MCS-107		Computer Graphics	100	4
	MCS-108		Data Communication and Computer Networks	100	4
	MCS -109		Database Management System	100	4
	MCS -110(P)		Practical Work (Based on 107 & 109)	100	2
Credit of II semester				**500**	**18**
Third	MCS-111		Design and Analysis of Algorithm	100	4
	MCS-112		Java Programming	100	4
	MCS-113		Theory of Computation	100	4
	MCS-114		Multimedia Technology	100	4
	MCS-115(P)		Practical Work (Based on 111 & 112)	100	2
Credit of III semester				**500**	**18**
Fourth	MCS-116		Operating System	100	4
	MCS-117		Soft Computing	100	4
	MCS-118(P)		Practical Work (Based on 116 & 117)	100	2
	Select any one Group				
	Group 1	MCS-119	Information and Network Security	100	4
		MCS-120	System Software	100	4
	OR				
	Group 2	MCS-121	Dissertation with viva voce	200	8
Credit of IV semester				**500**	**18**
Total Credit				**2000**	**72**

Detailed Syllabus

MCS-101 Discrete Mathematics

Block—01: Language of Mathematics and its application

Unit-01: Mathematical Logic: statements, operations, truth values, tautology and quantifiers.

Unit 02: Arguments: Rule of Detachment, Validity of a compound statement by using Truth Table , Validity using Simplification Methods, Validity using Rules of Inference, Invalidity of an Argument, Indirect Method of proof and Proof by Counter-Example.

Unit – 03: Boolean Algebra: Boolean Algbera, Principle of Duality, Isomorphic Boolean Algebras, Boolean Algebra as Lattices, Boolean Functions, Disjunctive Normal Form**,** Conjunctive Normal Form**,** Minimization of Boolean Functions (Karnaugh Map)

Unit – 04: Switching circuits and logical Circuits : Switching Circuits, Simplification of circuit, Non-Series Parallel Circuits, Relay Circuits, Logic Circuits

Block – 02: Set theory and its application

Unit-01: Set theory: sets, Subsets, Operations on Sets, Complementation, Intersection and Union, Laws Relating Operations, Distributive Laws and De Morgan's Laws.

Unit -02: Relation: Relation, binary relations in a Set, Domain and Range of a Relation, Total number of Distinct Relations, Relations as Sets of Ordered Pairs, Types of Relations, Composition of Relations, Equivalence relation in a set, Partition of a Set, Equivalence Class and Quotient set of a set.

Unit – 03: Partitions and Distributions: Equivalence Relations, Equivalence Classes, Properties of Equivalence Classes, Quotient set and Partition.

Unit – 04: Function: Functions, Direct and Inverse image, Inverse Functions, Operations on Functions, Composite of functions, Types of Functions and Connection between Equivalence relation and mapping.

Block – 03: Counting Process

Unit-01: Mathematical Induction: Principle of Mathematical Induction, Second Principle of Induction and Well ordering property.

Unit -02: Combinatorics: Basic counting principles**,** Principle of Disjunctive counting, Principle of Sequential counting and Ordered and Unordered Partitions.

Unit – 03: Permutation

Unit – 04: Combination

Block – 04: Probability theory and application

Unit-01: Binomial theorem: Binomial theorem, General term in a binomial expansion, Middle term in a binomial expansion and Binomial expansion for rational exponents.

Unit -02: Probability: Definition of Probability, Addition law for counting and Product law for counting.

Unit – 03: General Counting methods: General Counting method is the extension part of counting process. It discusses Sum and Product Rulesand The Pigeonhole Principle **.**

Unit – 04: The Inclusion- Exclusion Principle: inclusion-exclusion principle, Alternative form of the inclusion-exclusion principle and Onto Functions.

MCS-102 C++ and Object oriented programming

BLOCK - 1

UNIT 1: Principles of object oriented programming

Object oricnted programming paradigm, Comparison with procedural programming, Basic concepts of object oriented programming, benefits of O0P, object oriented Languages, advantage of C++.

UNIT 2: Object Orient Programming System

Class, inheritance, abstraction, encapsulation and information hiding, polymorphism, overloading.

UNIT 3: Advanced concept

Dynamism (Dynamic typing., dynamic binding, late binding, dynamic loading). Structuring programs, reusability, organizing object oriented project,

BIOCK - 2

UNIT 5: Overview of C++

Tokens, keywords, identifiers and constants basic data types, user-defined and derived Data types, type compatibility, reference, variables type Casting, operator precedence, control structures, structure, function.

UNIT 6: Classes and objects

Class specification, class objects, accessing class members, scope resolution operator, data hiding, empty classes, Pointers within a class, passing objects as arguments, returning objects from functions, friend Functions and friend classes, constant parameters and member functions, structures and Classes, static members.

UNIT 7: Object initialization and cleanup

Constructors destructor, constructor overloading. order of construction and destruction, Constructors with default arguments, nameless objects, dynamic initialization through Constructors, constructors with dynamic operations, constant objects and constructor, static Data members with constructors and destructors, nested classes.

BLOCK - 3

UNIT 8: Operator overloading and type conversion

Defining operator overloading, overloading unary operators, overloading binary operators, overloading binary operators using friends, manipulation of strings using Operators, rules for overloading operators. type conversions.

UNIT 9: Inheritance: extending classes

Deriving derived classes, single multilevel, multiple, hierarchical, hybrid inheritance, Constructors & destructors in derived classes, constructors invocation and data members Initialization, virtual base classes, abstract classes, delegation.

BLOCK- 4

UNIT 10: Pointers, virtual functions and polymorphism

Pointers to objects, this pointer. pointers to derived classes, virtual functions, Implementation of run-time polymorphism, pure virtual functions.

UNIT 11: Working with files

Classes for file stream operations. opening and closing a file, file pointers and their Manipulations, sequential input and output operations, error handling during file Operations, command line arguments.

UNIT 12: Object Oriented Modeling

Need of object oriented Modeling, Simulation of real life problems using OOP concept: Example, Representation of problem using object and class diagrams at design level.

MCS-103 Data Structures

BLOCK - 1

UNIT 1: Introduction to data structure

Algorithm, Basic criteria for algorithms, Data type, Data structure, Data representation, linear and non linear data structure.

UNIT 2: Basics of algorithm

Algorithm, Basics of complexity of algorithm

UNIT 3:Array

Definition, Representation of array, Single and multi-dimensional array, address calculation (one dimensional, two dimensional, multidimensional), sparse matrices

BLOCK - 2

UNIT 4: Stack

Definition, Operations on stacks, Array representation and implementation of stadk; infix, prefix and postfix representation of expression and evaluation multiple stacks, Application of stacks.

UNIT 5: Recursion

Recursive definition and processes, some named problems of recursion, principle of recursion: designing recursive algorithm, how recursion works, tail recursion.

UNIT 6: Queue

Definition, operation on queues, circular queue, dequeue, priority queue, Application of queue.

BLOCK 3

UNIT 7: Linked List

Representation and implementation of single linked list, Operations in the singly linked list, stack and queue as a linked list, circularly linked list, doubly linked list, circularly doubly linked list, Application of linked list: polynomial representation and addition, garbage collection

UNIT 8: Tree

Basic terminology, binary tree, binary tree representation, complete binary tree, extended binary tree, array and linked list representations, traversing binary tree, threaded binary tree, binary search tree, Operations on BST, AVL tree, Operations on AVL tree, B-tree Insertion and deletion in B tree.

UNIT 9: Graph

Basic terminology Graph representation Depth first search, breadth first search, topological sort, connected components, spanning tree, minimum cost spanning tree, Kruskal's and prim's algorithm, Shortest path algorithms: Bellman Ford Algorithm, Dijkstra's algorithm, Floyd-Warshall algorithm.

BLOCK - 4

UNIT 10: Searching and sorting

Sequential search, binary search, comparison and analysis, Selection sort, Bubble sort, Insertion sort, Heap sort, Quick Sort, Merge sort, Shell sort, radix sort.

UNIT 11: Hashing

Hash table, hash function, collision resolution strategies, hash table implementation.

UNIT 12: File Structure

Terminology, File organization, Sequential files, Direct File organization, Indexed Sequential file organization.

MCS-104 Software Engineering

UNIT-I Software Engineering Fundamentals: Definition of Software, Software characteristics, Software Applications. Software Process: Software Process Models - Waterfall model, prototyping model, spiral model, incremental model, concurrent development model. Project management Concepts: The Management Spectrum - The People, The Product The Process, The Project.

UNIT-II Software Process and Project Metrics : Measures , Metrics and Indicators , Software measurement Size -Oriented Metrics , Function - Oriented Metrics , Extended Function point metrics Software Project Planning : Project Planning Objectives , Software Project Estimation , Decomposition Techniques - Problem Based Estimation Process Based Estimation ,Empirical Estimation Models- The COCOMO Model Risk Analysis and Management: Software risks, Risk identification, Risk Projection, Risk Refinement, Risk Mitigation , Monitoring and Management.

UNIT-III Software Quality Assurance: Basic concepts- Quality, Quality Control, Quality Assurance, Cost of Quality , Software Quality Assurance (SQA) , Formal Technical Review Software Configuration Management: Baselines , Software Configuration Items, The SCM Process, Version Control, Change Control, Configuration Audit, Status Reporting. Analysis Concepts and Principles: Requirements Elicitation for Software, Analysis Principles. The Information Domain, Modeling, Partitioning, Essential and Implementation Views, Specification: Specification Principles, Representation, The Software Requirement Specification (SRS)

UNIT-IV Design Concepts and Principles: Design Principles, Design Concepts — Abstraction, Refinement, Modularity, Software Architecture, Control Hierarchy, Structural Partitioning, Data Structure. Software Procedure, Structure, Information Hiding, Effective Modular Design- Cohesion, Coupling Software Testing: Testing Objectives & principles, Unit Testing, Integration Testing (Top Down Integration , Bottom. Up Integration, Regression Testing, Smoke Testing), Validation Testing (Alpha and Beta Testing), System Testing (Recovery Testing, Security Testing, Stress Testing, Performance Testing).

UNIT-V Reengineering: Software Reengineering, Reverse Engineering, Restructuring, Forward Engineering CASE Tools: What is CASE, Building Blocks of CASE, A Taxonomy of CASE Tools, Integrated CASE Environments, The integration Architecture, The CASE Repository.

MCS-106 Computer Organization

Block 1: Introduction to Digital Electronics

Unit 1: Introduction to number system: binary, octal, hexadecimal, Inter-conversion to different number system.

Unit 2: Boolean algebra and Logic Gates: De Morgan's theorem, Boolean Identity. OR, AND NOT NAND, NOR and Ex OR gates and there Truth Tables, Positive and Negative logic.

Unit 3: Reduction Techniques: Standard representation of Boolean expressions, SOP and POS forms, Combinational and sequential circuits, Minterm and Maxterm expressions, Map reduction techniques, K- tap. Code Conversions: Binary to Gray, BCD to decimal etc.

Unit 4: Binary Arithmetic: Half and Full Adder, Substractor, Multiplexer, Demultiplxer, Decoder, Encoders, Comparators.

Unit 5: Sequential Circuit: Flip Flops: S/R, J/K, D and T Latches, Digital Counters, Registers.

Block 2: Basic building blocks

Unit 1: Building blocks: I/O, Memory, ALU and its components, Control Unit and its functions

Unit 2: Instruction — word, Instruction and Execution cycle, branch, skip, jump and shift instruction, Operation of control. registers; Controlling of arithmetic operation.

Unit 3: Addressing techniques — Direct, Indirect, Immediate, Relative, Indexed addressing and paging. Registers —Indexed, General purpose, Special purpose, overflow, carry, shift, scratch, Memory Buffer register; accumulators; stack pointers; floating point; status information and buffer registers.

Block 3: Memory & I/O

Unit 1: Memory: Main memory, RAM, static and dynamic, ROM, EPROM, EEPROM, EAROM, Cache and Virtual memory.

Unit 2: I/O System: Buses, Interfacing buses, Bus formats- address, data and control, Interfacing keyboard, display, auxiliary storage devices and printers.

Unit 3: Introduction to Microprocessors and microcontrollers; Introduction to 8085 microprocessor, example of few instruction to understand addressing techniques, differences between microprocessors and microcontrollers. Interlocution to different processor families.

BLOCK 1: Raster Graphics and Clipping

Unit 1: Introduction to Computer Graphics

- What is Computer Graphics?
- Application of Computer Graphics
  - Presentation Graphics, Painting and Drawing, Photo Editing, Scientific Visualization, Image Processing, Digital Art, Education, training, Entertainment and CAD Simulation, Animation and Games
- Graphics Hardware
- Input and Output Devices
  - Touch Panel, Light Pens, Graphic Tablets, Plotters, Film Recorders
- Display Devices
- Refreshing Display Devices: Raster-Scan, Random-Scan
- Plasma Panel and LCD panels

Unit 2: Graphics Primitives

- **Points and Lines**
- Line-drawing Algorithms: **DDA Algorithm, Bresenham's line Algorithm**
- Circle-generating Algorithm: **Properties of Circles, Midpoint Circle of Algorithm**
- Polygon Filling Algorithm: Scan-Line

Unit 3: 2-D Viewing and Clipping

- Point Clipping
- Line Clipping: Cohen-Sutherland Line Clippings, Cyrus-Beck Line Clipping Algorithm
- **Polygon Clipping: Sutherland Hodgman Algorithm**
- Windowing Transformation

BLOCK 2: Transformations

Unit 4: 2-D and 3-D Transformations

- Basic Transformations: Translation, Rotation, Scaling, Shear
- **Composite Transformations: Rotations about a point, Reflection about a line**
- Homogeneous Coordinate Systems
- 3-D Transformations

Unit 5: Viewing Transformation

- Projections: Parallel Projection, Orthographic & Oblique Projections, Isometric Projections, Perspective Projections

BLOCK 3: Modeling & Rendering

Unit 6: Curves and Surfaces

- Polygon Representation Methods: Polygon Surfaces, Polygon Tables, Plane Equations, Polygon Meshes
  - Bezier Curves and Surfaces: B**ezier Curves, Properties of Bezier Curves, Bezier Surfaces**
  - Surface of Revolution

Unit 7: Visible – Surface Detection

- Depth Buffer Method
- Scan-Line Method
- Area-Subdivision Method

Unit 8: Polygon Rendering and Ray Tracing Methods

- **Illumination Model:** Ambient Reflection, Diffuse Reflection, Specular Reflection
  - Shading: **Gouraud Shading, Phong Shading**
  - Ray Tracing: **Basic Ray-Tracing Algorithm**

MCS-108 Data Communication and Computer Networks

Block 1: Computer Networks Basics

Introduction: Layered network architecture, Review of ISO-OSI Model. Data Communication techniques: Pulse code Modulation, (PCM), Data modems, Multiplexing techniques –Frequency-Division, Time-Division, Time-Division Transmission Media-Wires, Cables, Radio, Links, Fiber-Optic Links.

Asynchronous Transfer Mode (ATM); Cell Format, Layovers in ATM, Class 1,2,3,4 Traffic Random Access Data Networks, Concept of Random Access, Pure ALOHA; Throughput Characteristics Slotted ALOHA, Throughputs for Finite and Infinite, Population S-ALOHAS. MARKOV Chain Model for S- ALOHAS. Throughputs for Finite and Infinite, Population S- ALOHAS. MARKOV Chain Model for S-ALOHA.

Block 2: Data Link layer

Local Area Networks (LANs): IEEE 802.4 and 802.5 Protocols. Performance of Ethernet and Token ring protocols, FDDI Protocol , Distributed Queues Dual Bus (DQDB) Protocol.

Data Link Protocols: Stop and Wait Protocols: Noise Free and Noisy Channels Performance and Efficiency, Verification of protocols using Finite State Marching. HDLC Data Link Protocol.

Block 3: Network & Transport Layer

Network Layer Protocols: Design issue: Virtual circuits and Datagram.

Integrated Services Digital Network: Interfaces, Devices, Channel Structure. Dead Locks ad their avoidance Network Layer in ATM, Internetworking: Bridges, Routers and Gateways, Internet Architecture and Addressing.

Transport Layer Protocols: Design issues: Quality of Services, Primitives Connection Management: Addressing, Connection Establishment and Releases, Use of Timers, Flow Control and Buffering, Multiplexing, Crash Recovery.

Block 4: Upper Layer Protocols

Routing Algorithms: Optimality Principle, Shortest Path Routing- Dijkstra, Bellman – Ford and Floyd- War shall Algorithm.

Elements of TCP/IP Protocol: User Datagram Protocol Connection Management, Finite State Machine.

Session Layer Protocols: Dialog Management, Synchronization, OSI Session Primitives Connection Establishment Presentation and Application Layer Protocols: Presentation Concepts NMP- Abstract Syntax Notation-1 (ASN-1), Structure of Management, Management Information Base.

MCS-109 Data Base Management System

Unit 1: Introduction: Database Management System, Examples, Characteristics of the Database Approach, Advantage of using a Database Approach. Database System concepts and Architecture, Data Models, Schemes and Instances, DBMS Architecture and Data independence, Database Languages, Procedural and Non-procedural languages and Interfaces. Database System Environment, Classification of Database Management Systems.
Unit 2: ER Model: Database Modeling using the ER Model., Using High-Level conceptual Data Models for Database design, An example Database Application, Entity types, Entity Sets, Attributes and keys, Relationships, Relationship types, roles and Structural Constraints., Week Entity types, Refining the ER Design for the Company Database, ER Diagrams, naming conventions and design Issues, Conversion of ER Diagram to tables.

Unit 3: Relational Model: The Relational Data Model, Relational constraints. the Relational Algebra: Relational Model Concepts, Relational concepts and Relational Database Schemes, Update Operation and Dealing with Constraints Violations, Relational Database Design, Using ER-to-Relational Mapping.

Unit 4: Structured Query language: Data definition, Constraints and Schema changes in SQL 2, Basic Quires in SQL, More Complex SQL Quires, Insert, Delete and Update Statements in SQL, views(Virtual Tables) in SQL, Specifying general constraints as Assertion features of SQL. Integrity constrains, Triggers, Functional dependencies.

Unit 5: Normalization: Functional Dependencies and Normalization for Relational Database, Informal Design Guidelines for Schemes, Functional Dependencies, Normal Forms based on Primary keys, General Definitions of Second and Third Normal forms, Boyce Codd Normal form, Relational Database Design Algorithms and Further Dependencies, Algorithms for Relational Database Schema Design, Multi-valued Dependencies and Fourth Normal Form, Join Dependencies and Fifth Normal Form, Inclusion Dependencies, Other Dependencies and Normal Forms.

Unit 6: Transaction Processing Concepts: Introduction to Transaction Processing, Transaction and System Concept, Desirable properties of Transactions, Scheduling and Recoverability, Serializability of Scheduling, Transaction Support in SQL, Concurrency control techniques, Concurrency techniques for concurrency control, concurrency control based on timestamp based protocol, validation based protocol, deadlock handling, Database Recovery Techniques based on Immediate Update, Failure classification, Shadow Paging, Log based recovery, failure with loss of Nonvolatile Storage.

Unit 7: Emerging Trends in DBMS
Introduction to object oriented Database Management System, Introduction to client/Server Database, Introduction to Distributed Database, Introduction to Knowledge Databases.

MCS-111 DESIGN AND ANALYSIS OF ALGORITHMS Credit 4(3-1-0)

Overview: Introduction to basic techniques for designing and analyzing algorithms, including asymptotic analysis and recurrences; divide-and-conquer algorithms; lower bound for comparison based sorting methods, sorting in linear time, greedy algorithms; dynamic programming; backtracking and some graph algorithms for path problems.

BLOCK 1: Introduction and Design Strategies-I

UNIT 1: Introduction: Algorithm, Psuedo code for expressing algorithms, Performance Analysis-Space complexity, Time complexity, Growth of functions: Asymptotic Notation, Recurrences: substitution method, master method.

UNIT 2: Divide and Conquer: General method, applications-Binary search, Finding the maximum and minimum, Quick sort, Heapsort, Strassen's Matrix Multiplication.

UNIT 3: Sorting in Linear Time: Lower bounds for sorting, Counting sort, Radix sort, Bucket sort, Medians and Order Statistics, Minimum and maximum.

BLOCK 2: Algorithm Design Strategies-II

UNIT 4: Greedy method: General method, applications- Knapsack problem, Job sequencing with deadlines, optimal two way merge patterns, Huffman codes, Minimum cost spanning trees: Prims and Kruskal's algorithm, Single source shortest paths: The Bellman-Ford algorithm, Dijkstra's algorithm.

UNIT 5: Dynamic Programming: General method, applications, capital budgeting problem, Multistage graphs, Matrix chain multiplication, 0/1 knapsack problem, All pairs shortest path problem, Travelling sales person problem.

BLOCK 3: Algorithm design strategies & Completeness

UNIT 6: Graph Algorithms: Introduction, representation of graphs, Breadth first search, depth first search, topological sort, strongly connected component, flow networks, ford-fulkerson method.

UNIT 7: Backtracking: General method, applications, 8-queen problem, sum of subsets problem, graph coloring, Hamiltonian cycles.

UNIT 8: Branch-And-Bound: The method, travelling salesperson problem, 15 puzzle problem.

UNIT 9: NP-Hard and NP-Complete problems: Basic concepts, non deterministic algorithms, NP - Hard and NP Complete classes, satisfiability problem, reducibility.

MCS-112 Java Programming

Block 1: Object Oriented Methodology and Java

Unit 1: Object Oriented Programming

Paradigms of Programming languages, Evolution of Object Oriented Methodology, Basic Concepts of OO Approach, Comparison of object oriented and procedure - oriented Approaches, Benefits of OOPS, Applications of OOPS. Classes and objects, Abstraction and Encapsulation, Inheritance, Method overriding and Polymorphism.

Unit 2: Java Language Basics

Introduction to Java, Primitive Data Type and Variables, Java Operators.

Unit 3: Expressions Statements and Arrays

Expressions, Statements, Control Statements, Selection Statements, Iterative Statements, Jump statements, Arrays.

Block 2: Object oriented concepts and Exceptions Handling

Unit 4: Class and objects

Class Fundamentals, Introducing Methods, this Keyword, Using objects as Parameters, Method overloading, Garbage collection, the ffinalize () Method.

Unit 5: Inheritance and Polymorphism

Inheritance Basics, Access, Multilevel, inheritance, Method overriding Abstract classes, Polymorphism, Final Keyword.

Unit 6: Packages and interfaces

Package, Accessibility of Packages, using Package members, Interfaces, Implementing interfaces, interface and Abstract classes, Extends and Implements together.

Unit 7: Exceptions Handling

Exception, Handling of Exception, Types of Exceptions, Throwing, Exceptions, writing Exception subclasses.

Block 3: Multithreading, I/O, and Strings Handling

Unit 8: Multithreaded Programming

Multithreading, The Main thread, JAVA Thread Model, Thread Priorities, Synchronization inJAVA, Inter thread Communication.

Unit : I/O In Java

I/O Basics, Streams and stream, Classes, the predefined streams, Reading from and writing to console, reading and writing files, the transient and volatile Modifiers, using instance of Native
Methods.

Unit 10: Strings and Characters

Fundamental of Characters and Strings, the String class, String operations, Data Conversion using value of () Methods, Strings Buffer and Methods.

Unit 11: Exploring Java I/O

Java I/O classes and interfaces, Stream classes, Text streams, Stream Tokenizer, Serialization, Buffered stream, print stream, Random Access file.

Block 4: Graphics and user interfaces

Unit 12: Applets

The applet class, Applet architecture, An applet Skeleton: Initialization and Termination, Handling events, HTML Applet TAG.

Unit 13: Graphics and user interfaces

Graphics contests and Graphics objects, user interface components, Building user interface with AWT, Swing - Based GUI, Layouts and layouts and layout Manager, Container.

Unit 4: Networking Features

Socket overview, reserved parts and proxy servers, Internet Addressing: Domain Naming Services (DNS),
Java and The Net: URL, TCP/IP Sockets, Datagrams.

MCS-113 **Theory of Computation**

Block 1 Regular Expression and Finite Automata

Unit-1: Alphabet, Strings and Languages

Set, Relations, Alphabet,Strings,Languages,Finite Representation of Languages, Chomasky Hierarchy

Unit-2: Finite Automata

Finite State Systems, Basic Definitions Non-Deterministic finite automata (NDFA), Deterministic finite automata (DFA), Equivalence of DFA and NDFA, Finite automata with epsilon transitions, Removal of epsilon transitions.

Unit-3: Regular Expressions

Regular Expressions-Definition, Algebraic Laws of RE,Finite Automata and Regular expressions,Conversion from RE to FA , Conversion from FA to RE , Arden's Theorem.

Unit-4: Introduction to Machines

Concept of basic Machine, Properties and limitations of FSM.Moore and mealy Machines, Equivalence of Moore and Mealy machines. Minimization of DFA.

Block 2 Context Free Grammar

Unit-5: Properties of Regular Language

The Pumping Lemma for Regular Sets, Applications of the pumping lemma, Closure properties of regular sets.

Unit-6:Context Free Grammar

Context Free Grammar(CFG)-Formal definition, sentential forms, leftmost and rightmost derivations, the language of CFG.

Unit-7: Normal Forms

Simplifications of CFG's- Removal of Useless Symbols, Removal of epsilon and Unit Production, Normal Forms-CNF and GNF.

Unit-8: Context Free Languages(CFL)

Closure Properties of CFL,Decision Properties of CFL,Application of CFG,Pumping Lemma for CFL.

Block 3 Pushdown Automata and Turing Machine

Unit-9: Push Down Automata

Formal Definition of Pushdown Automata, Pushdown Automata accepted by final state and empty state, Equivalence between CFG and PDA.

Unit-10: Turing Machine

Turing Machine(TM) –Formal Definition and behavior, Transitiondiagram, Instantaneous Description, Language of a TM,Variants of TM, Universal Turing Machine, Halting Problem, Church Thesis.

Unit-11: Undecidability

Recursive enumerable, Undecidable Problem About Turing Machines, Unsolvable Problems.

MCS-114 **Multimedia** Technology

UNIT-I 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

UNIT-II Multimedia Audio: Digital sound; Audio compression & decompression; Companding: ADPCM compression; MPEG audio compression; True Speech; 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

UNIT-III 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

UNIT-IV Creating Multimedia Animation: 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

UNIT-V Multimedia Authoring Tools: Project editor; Topic editor; Hot-spot editor; Developing a multimedia title; Multimedia text authoring systems; Usage of authoring tools

UNIT-VI 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.

MCS-116 Operating System

BLOCK 1

UNIT 1: Introduction

Basic definitions, Batch processing, Multi-pr programming. Time sharing, multiprocessing; Structure and Functions of Operating System

UNIT 2: Process and thread

Process, Process states, State Transitions, Process Control Block, Context Switching, concept of thread, comparison between process and thread, Thread model, thread usage, implementing thread in kernel and user space.

UNIT 3: Process Scheduling

Scheduler, Scheduling criteria, Preemptive and non-preemptive scheduling, Process Scheduling, Process scheduling algorithms.

UNIT 4: Concurrent Process

Process Interaction, Shared Data and Critical Section, Mutual Exclusion, Synchronization, Classical Problems of Synchronization, Semaphores, Monitors.

BLOCK - 2

UNIT 5: Deadlock

Concept of deadlock, necessary condition for deadlock, resource allocation graph, deadlock prevention, deadlock avoidance, Banker's algorithm, Deadlock detection, deadlock recovery.

UNIT 6: Memory management

Address Binding, Dynamic Loading and Linking Concepts, Logical and Physical Addresses Contiguous and non-contiguous memory allocation, Paging, Segmentation, Virtual Memory, Demand Paging, Page fault, Page replacement algorithms, thrashing.

UNIT 7: Secondary memory management:

Free Space management, Disk Structure, Disk Scheduling, Formatting, Swap space Management.

UNIT 7: Case Study of UNIX

MCS-117 SOFT COMPUTING

Block 1: ARTIFICIAL INTELLIGENCE & SOFT COMPUTING

Introduction of Artificial Intelligence, Problem domain of AI, AI techniques, Rule based system, monotonic reasoning, non-monotonic reasoning, Uncertainty reasoning & Inference, Bayesian theory and dependency network, Limitation of AI, Soft computing paradigms, pattern classification, association and mapping.Pattern recognition techniques.

Block 2: FUZZY SET THEORY

Introduction to Neuro – Fuzzy and Soft Computing – Fuzzy Sets – Basic Definition and Terminology – Set-theoretic Operations – Member Function Formulation and Parameterization – Fuzzy Rules and Fuzzy Reasoning – Extension Principle and Fuzzy Relations – Fuzzy If-Then Rules – Fuzzy Reasoning – Fuzzy Inference Systems.

Block 3: NEURAL NETWORK

Neural Network : Structure and Function of a single neuron: Biological neuron, artificialneuron, definition of ANN, Taxonomy of neural net, Difference between ANN and human brain,characteristics and applications of ANN, single layer network, Perceptron training algorithm,Linear separability, Widrow&Hebb's learning rule/Delta rule, ADALINE, MADALINE, AI v/s ANN.Introduction of MLP, different activation functions, Error back propagation algorithm, derivation ofBBPA, momentum, limitation, characteristics and application of EBPA, Deep Learning: Convolution Neural Network, Recurrent Neural Network.

Block 4: GENETIC ALGORITHM

Genetic algorithm : Fundamentals, basic concepts, working principle, encoding, fitnessfunction, reproduction, Genetic modeling: Inheritance operator, cross over, inversion & deletion,mutation operator, Bitwise operator, Generational Cycle, Convergence of GA, Applications &advances in GA, Differences & similarities between GA & other traditional method.

Text Books:

1. J.S.R.Jang, C.T.Sun and E.Mizutani, "Neuro-Fuzzy and Soft Computing", PHI, 2004, Pearson Education 2004.
2. S. Rajasekaran and G.A.VijaylakshmiPai.. Neural Networks Fuzzy Logic, and Genetic Algorithms, Prentice Hall of India.

REFERENCES

1. Timothy J.Ross, "Fuzzy Logic with Engineering Applications", McGraw-Hill, 1997.
2. Davis E.Goldberg, "Genetic Algorithms: Search, Optimization and Machine Learning", Addison Wesley, N.Y., 1989.
3. S. Rajasekaran and G.A.V.Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithms", PHI, 2003.
4. R.Eberhart, P.Simpson and R.Dobbins, "Computational Intelligence - PC Tools", AP Professional, Boston, 1996.

MCS-119 Information and Network Security

Block 1: Information security and Symmetric Ciphers

UNIT 1: Introduction: History, What is Information Security; Characteristics of Information; Information Security Model; Components of an Information Security; Aspects of Information security: Security attacks, Security Mechanism, and Security Services (X.800), Model for Network Security.

Unit 2: Classical Encryption Techniques: Historical background,symmetric cipher model, Substitution techniques, Transpositiontechniques, steganography.

Unit 3: Block ciphers and DES: Block cipher principles, Data encryption standard, strength of DES, differential and cryptanalysis, block cipher design principles, block cipher mode of operation.

Unit 4: Confidentiality Using Symmetric Ciphers: Placement of encryption function, traffic confidentiality, key distribution, random number generation.

Block 2: Public key Encryption and Hash Functions

Unit 5: Introduction to Number Theory: Prime numbers, Fermat's and Euler's theorem, discrete logarithm

Unit 6: Public Key Cryptography: Public-Key Cryptography Principles, RSA, Key Management: Diffi-Hellman key exchange.

Unit 7: Message Authentication and Hash Functions: Authentication requirements, Authentication Functions, Message Authentication codes, Hash Functions, SHA-1, MD5.

Unit 8: Digital Signatures: Digital signatures, Authentication protocols, Digital Signature standard

Block 3: Network Security Applications

Unit 9: Authentication Applications: Kerberos Motivation, X.509 authentication service

Unit 10: Electronic Mail Security: PGP: PGP Notation, PGP Operational Description, , S/MIME

Unit 11: IP Security:IP Security Overview, IP Security Architecture, Authentication Header

Uni12: Web Security: Web Security Threats, Web Traffic Security Approaches, Overview of Secure Socket Layer and Transport LayerSecurity, Overview of Secure Electronic Transaction

Block 4: Intruders and Viruses

Unit 13: Intruders: Intruders, Intrusion Techniques, Password Protection, Password Selection Strategies, Intrusion Detection,

Unit 14: Malicious Programs MaliciousPrograms, Nature of Viruses, Types of Viruses, Macro Viruses, Antivirus Approaches

Unit 15:Firewall: Firewall Characteristics, Types of Firewalls, Firewall Configuration

MCS-120 System Software

Block 1: Introduction to System Software and software tools

Unit 1: Language Processors: Introduction, Language Processing Activities, Fundamentals of Language Processing & Language Specification, Language Processor Development Tools.
Unit 2: Data Structures for Language Processing: Search Data structures, Allocation Data Structures.
Unit 3: Software Tools: Software Tools for Program Development, Editors, Debug Monitors, Programming Environments, and User Interfaces.
Unit 4: Assemblers: Elements of Assembly Language Programming, A Simple Assembly Scheme, Pass Structure of Assemblers, Design of a Two Pass Assembler, A single pass Assembler for IBM PC.
Unit 5: Macro Processors: Macros and Macro Processors: Macro Definition and Call, Macro Expansion, Nested Macro Calls, Advanced Macro Facilities, Design of a Macro Preprocessor.

Block 2: Compilers and Interpreters

UNIT 6 COMPILER- LEXICAL ANALYSIS
Introduction to NFA and DFA, 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.
UNIT 7 COMPILER- SYNTAX ANALYSIS
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.(First and follow technique for generating a parse table is to be taught), Phases of the Compiler, Aspects of compilation, Memory allocation. Compilation of expressions and control structures.
UNIT 8 COMPILER- CODE GENERATION
Intermediate languages: graphical representations, DAGs, Three address code, types of threeaddress statements, syntax directed translation into three address code, implementation of three address statements.
UNIT 9 COMPILER- OPTIMIZATION Code Optimization: Machine dependent and machine independent code generation: Sources of optimization-Code Generation-Semantic stacks, evaluation of expressions, control structures, and procedure calls.
Unit 10: Interpreters: Use and overview of interpreters, pure and impure interpreters

Block 3: Linker, Loaders and device Drivers

Unit 11: LoadersandLinkers
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.
Unit 12: Device drivers
Design and anatomy of UNIX device driver, Types of device driver, General design of UNIX character device driver, General design of UNIX block device driver, UNIX device driver installation.