

**NORTH MAHARASHTRA UNIVERSITY, JALGAON**  
**Faculty of Engineering and Technology**  
**Pre PhD course No: 2 Syllabus**  
**Computer Engineering and Information Technology**

**Unit-I**

**Graph Theory:**

Basic terminology, multigraphs and weighted graph , paths and circuits , shortest path algorithm, Euler and Hamiltonian Paths and circuits , factors of a graph, Planer graph.

Trees: Trees, rooted trees, path length in rooted trees, prefix code, binary search trees, spanning trees and cut set, minimum spanning trees. Set Theory: Set, Combinations of Sets, Mathematical Induction, and Principle of inclusion and Exclusion.

**Theory of Computation:**

Finite State Machines: Deterministic and Non-deterministic FSM's, Moore and Mealy FSM's. Regular Expressions: Converting DFA's to RE. Context Free Grammars: Definition, Simplification of CFG. Pushdown Stack Memory Machines: Power of PDM over FSM. Universal TM.

**Unit-II**

**Operating Systems:**

System calls, OS structure like monolithic, layered, kernel based, micro-kernel based. CPU Scheduling: algorithms and performance evaluation. Inter-process communication and synchronization needs: Mutual exclusion, semaphores. Deadlock: Principles, detection, prevention, avoidance and recovery. Virtual memory management: Concepts, implementation. File management: concepts, free space management. Security and protection: goals of security and protection, security and attacks,.

**System Programming:**

System software: Assemblers, Loaders, Compilers, Interpreters, Macros, Operating system and formula system, Translators. Compiler: Types, Overview of compilation process, Phases of compiler.

**Unit-III**

**Software Engineering:**

Planning and Managing Software projects: Metrics for software quality, Software Acquisition, Software risks, Monitoring Project Scheduling, Work break down structures, Project plan. Requirement Analysis: Communication Techniques, FAST, Quality deployment, Data flow Diagrams. Design Fundamentals: Software Design and software design process, Abstractions, Refinement and modularity. Software Testing Techniques and Strategies: Software testing fundamentals.

**Data Base Management Systems:**

Database administration issues: DBA role, Data dictionary, security, backups, Replication. Data modeling: Basic concepts, types of data models, E-R data model E-R and ER diagramming. SQL: Structure of a SQL query, DDL and DML, SQL queries, set operations. Transaction Management: Basic concepts of transaction, Different concurrency control protocols. Normalization: Need of normalization, Types of normalization. Object oriented DBMS: Review of object oriented concepts: Objects, Classes, attributes, Messages, Inheritance, and Polymorphism.

## **Unit-IV**

### **Data Structures:**

Data Structures: Stack Queue, Circular Queue, and Array. Fundamental operations on data structures. Applications of stack, Polish notations and interconversions. Linked List: Creation, insertion, deletion, traversing. Linked stack and linked queue.

Binary tree, binary search tree, threaded binary tree, Huffman algorithm, height balanced tree.

### **Algorithms:**

Algorithm analysis, complexity issues, designing algorithms. Divide and Conquer method: Binary search, merge sort, quick sort. Probabilistic analysis and randomized algorithms. Branch and Bound: Traveling salesman's problem. Greedy Algorithms: Elements of greedy algorithms.

## **Unit- V**

### **Computer Networks:**

OSI and TCP/IP reference models. Network Layer: Logical Addressing - IPv4 addresses- Address space, notations, Classful addressing, Classless Addressing, IPv6 addresses- Structure and address space, IPv6- Advantages over IPV4. Unicast Routing Protocols: Optimization, Intra and Inter domain routing, distance vector routing, link state routing, path vector routing. TCP: process to process communication, UDP, TCP/IP protocol suit, addressing. Congestion control: open- loop, closed- loop congestion control in TCP.

### **Reference Books:**

1. C.L. Liu , " Elements of Discrete Mathematics", 2<sup>nd</sup> edition, TMH.
2. J. Treamblay , R. Manohar , " Discrete Mathematical structures with application to computer science" , TMH.
3. K.L.P.Mishra, "Theory of Computer Science", PHI.
4. E V Krishnamurthy, "Theory of Computer Science", EWP.
5. Silberschatz, Galvin, Gagne, "Operating System Concepts", 7<sup>th</sup> Ed,Wiley India.
6. D.M. Dhamdhere, "Operating Systems", Tata McGraw Hill, 2<sup>nd</sup> Ed.
7. John J. Donovan "System Programming", TMH.
8. Pressman, "Software Engineering", McGraw Hill, 6<sup>th</sup> Ed.
9. Henry F. Korth, Abraham silberschatz, "Database system concepts", 5th Ed.Mc Graw Hill Inc.
10. Singh, "Database Systems: Concepts,Design & Aplication"- Pearson LPE.
11. Ellis Horowitz and Sahani, "Fundamentals of data Structure" Galgotia.
12. Seymour Lipschutz, "Data Structures", Schaum's Outline.
13. Thomas H. Cormen and charles E.L. Leiserson, " Introduction to Algorithm", PHI, 2<sup>nd</sup> Ed.
14. Aho , "Design & Analysis of Computer Algorithms"- Pearson LPE.
15. Andrew S. Tanenbaum, "Computer Networks", 4th edition, Pearson LPE /PHI.
16. Behrouz Forouzan, "Data Communications and Networking", TMH, 4<sup>th</sup> Ed.