

# Ph.D. Entrance Exam Syllabus

# PAPER – II (COMPUTER ENGINEERING)

#### **Discrete Mathematics**

Definition and types of sets, Equal sets, subsets, universal sets, Venn diagram, Set operations, Properties of set union and intersections. (with Venn diagrammatic proofs only) Propositions, Logical connectives and compound statements, Truth values and truth table, Statement Pattern and logical equivalence, Tautology, contradiction, contingency, Validity of arguments, Predicates

# Data Structure & Analysis of Algorithm

**Data structure:** operation, Arrays, Stack, Queue, Tree, Linked list Searching and Sorting Algorithm, Minimum Spanning Trees, Graphs : DFS and BFS algorithms associated with Graphs, Divide and conquer, Introduction to Greedy method, Introduction to Dynamic Programming, Introduction to NP Theory

Algorithm Analysis: Time Space Tradeoff, Asymptotic Notations, Recurrence equations, Mathematical Analysis of Non-recursive Algorithm, Mathematical Analysis of Recursive Algorithm, Empirical Analysis of Algorithms, Algorithm Visualization

# **Software Engineering**

System Development Life Cycle (SDLC): Steps, Water fall model, Prototypes, Spiral model. Software Metrics: Software Project Management. Software Design: System design, detailed design, function oriented design, object oriented design, user interface design. Design level metrics. Coding and testing: Testing level metrics, Software quality and reliability, Clean room Approach, software reengineering.

#### **Operating System & Database Management System**

**Operating System**: Main functions of operating systems. Multiprogramming, multiprocessing, and multitasking. Memory Management : Virtual memory, paging, fragmentation. Concurrent Processing : Mutual exclusion, Critical regions, lock and unlock. Scheduling : CPU scheduling, I/O scheduling, Resource scheduling, Deadlock and scheduling algorithms. Support for concurrent process, Scheduling, System deadlock, Multiprogramming system, I/O management, Distributed operating systems

**Database Management System:** Data models, Types of Database languages, Entity Relationship Model as a tool of conceptual design, Object Oriented Model, Concurrency Control, Database Security, File Organization, Set theory concepts and fundamentals:, Concepts of Keys, Relational Algebric Operations, Normalization, Normal Form: 1NF, 2NF, 3NF, Distributed Database

**Data mining & Datawarehouse:** Introduction, Evolution of data mining, Datamining –verification vs. discovery, Advantages of datamining, Technologies used in dataminnig, Metadata, Structure of a datawarehouse, Uses of a data warehouse, Standards reports and queries, Queries against summarised data, Data mining, Interface with other warehouse

#### Computer Networks & Security

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# **VIDHYADEEP**

A Communication model, Data Communication, Networking types (LAN, WAN, MAN), Types of signals(Analog & Digital.),Data encoding techniques, Bandwidth concepts, Channel capacity, Synchronous and asynchronous transmission. OSI reference Model, TCP/IP reference model, Networking devices(Repeaters, Bridges, Routers, Gateways, Hub and Switch), Protocols(SMTP, PPP, FTP, HTTP.)

**Mobile communication:** Introduction to Cellular Mobile Systems, Frequency Management & Channel Assignment, Hand Off & Dropped Call, types of handoff and their characteristics, dropped call rates & their evaluation.

**Network Security :** Network security issues, common threats, security barriers in the network pathways, types of security controls, approaches to network security, Ethical hacking. Encryption and Decryption – Cryptography, Type of encryptions, encryption keys, single/ secrete/ private key encryption, Public/Private key encryption. Overview of Digital Signature and Digital Certificates technology

# **Compiler Design**

Theory of Computation : Formal language, Deterministic Finite Automaton (DFA), Non-deterministic Finite Automaton (NFA), Regular languages and regular sets. Pushdown Automaton (PDA), Deterministic Pushdown Automaton (DPDA), Context free Grammars : Greibach Normal Form (GNF) and Chomsky Normal Form (CNF), Ambiguity, Parse Tree Representation of Derivations, Equivalence of PDA's and CFG's. Parsing techniques, Linear Bounded Automata (LBA), Context free grammars, Parsing and parse trees, YACC package on Unix system. Intermediate code generation, Code generation, Code optimization Top down parsers-left recursion and its removal, Recursive descent parser. Predictive parser, Intermediate codes-Quadruples, Triples, Intermediate code generation, Code optimization

#### **Recent trends in Computer Engineering**

**Artificial Intelligence**: Definitions, AI approach for solving problems. Automated Reasoning with propositional logic and predicate logic-fundamental proof procedure, refutation, resolution, refinements to resolution (ordering/pruning/restriction strategies). State space representation of problems, bounding functions, breadth first, depth first, A, A\*, AO\*, etc. Performance comparison of various search techniques. Components of an expert system, Knowledge representation and Acquisition techniques,. Tree Adjoining Grammars (TAGs).

**Machine Learning:** Introduction to Machine Learning (ML), Essential concepts of ML, Types of learning, Machine learning methods based on Time, Dimensionality – Linearity and Non linearity, Early trends in Machine learning – Data Understanding Representation and visualization. Machine Learning Methods, Linear methods, Regression, Classification, Perceptron and Neural networks, Decision trees, Support vector machines, Probabilistic models, Unsupervised learning, Featurization

**Cloud Computing:** Introduction to Cloud Computing, Cloud service providers; Properties, Characteristics & Disadvantages: Pros and Cons of Cloud Computing, Benefits of Cloud Computing, Cloud computing vs. Cluster computing vs. Grid computing; Role of Open Standards, Cloud Computing Architecture, Cloud Security

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