PhD Entrance test syllabus (50 marks)

School of Computer Science

Information Technology

Module 1: Database Management Systems (DBMS)

Introduction: Basic concepts, architecture, and data models (relational, hierarchical, network). SQL and Query Processing: DDL, DML, DCL; indexing, and query optimization.
Transactions and Concurrency: ACID properties, concurrency control techniques, and recovery mechanisms.
Normalization: Functional dependencies, normalization (1NF to BCNF), and denormalization.
Advanced Topics: NoSQL databases, distributed databases, and data warehousing.

Module 2: Programming Constructs
Programming Paradigms: Procedural, object-oriented, and functional programming.
Basic Constructs: Variables, loops, conditionals, arrays, and functions.
Object-Oriented Concepts: Encapsulation, inheritance, polymorphism, and abstraction.
Error Handling: Exception handling and debugging techniques.
Data Structures in Programming: Implementation of stacks, queues, and linked lists in C/C++/Python.

Module 3: Discrete Mathematics
Set Theory and Logic: Sets, relations, functions, and propositional logic.
Combinatorics: Permutations, combinations, and recurrence relations.
Graph Theory: Types of graphs, graph traversal algorithms, and applications.
Algebraic Structures: Groups, rings, and fields.
Boolean Algebra: Boolean functions, Karnaugh maps, and simplification techniques.

Module 4: Data Structures and Algorithms
Fundamentals of Data Structures: Arrays, stacks, queues, and linked lists.
Trees and Graphs: Binary trees, binary search trees, AVL trees, and graph traversal algorithms.
Algorithm Analysis: Time and space complexity, Big-O notation.

Sorting and Searching: Quick sort, merge sort, heap sort, and binary search.
Advanced Algorithms: Dynamic programming, greedy algorithms, and divide- and-conquer techniques.

Module 5: Artificial Intelligence (AI)
Introduction to AI: Definition, history, and applications.
Search Techniques: BFS, DFS, A*, and heuristic search.
Knowledge Representation: Logic-based representation, semantic nets, and frames.
Machine Learning Basics: Supervised, unsupervised, and reinforcement learning.
Image Processing Fundamentals: Image representation, enhancement, filtering, and morphological operations.
Computer Vision Basics: Edge detection, object recognition, feature extraction, and segmentation.