Ph.D. ADMISSION TEST (MR-PAT)

Ph.D. in Computer Applications

Module 1: Computer Networks

1.1 Network Protocol Design and Analysis
1.2 Software-Defined Networking (SDN)
1.3 Network Security and Cryptographic Protocols
1.4 Quality of Service (QoS) and Congestion Control
1.5 Wireless and Mobile Networks
1.6 Internet of Things (IoT) Networking
1.7 Network Simulation and Performance Analysis
1.8 Routing Algorithms and Protocols
1.9 Cyber Security, Information Security and Network Security
1.10 Edge and Cloud Network Architectures

Module 2: Operating Systems

2.1 Process Management and Scheduling Algorithms
2.2 Memory Management and Virtual Memory
2.3 File Systems and Storage Management
2.4 Concurrency, Deadlocks, and Synchronization
2.5 Kernel Architecture and Monolithic vs Microkernels
2.6 Device Management and I/O Systems
2.7 Security and Access Control Mechanisms
2.8 Virtualization and Containerization
2.9 Operating System Support for Distributed Systems
2.10 Energy-Aware and Real-Time Operating Systems

Module 3: Data Structures

3. 1. Linear Data Structures: Arrays, Linked Lists, Stacks, and Queues
3. 2. Trees: Binary Trees, Binary Search Trees (BST), Tree traversals
    (Inorder, Preorder, Postorder), Balanced trees: AVL Trees, B-Trees, and
     B+ Trees, Heap and Heap Operations (Min-Heap, Max-Heap)
3. 3 Graphs: Graph traversal: BFS, DFS, Minimum Spanning Tree: Prim's
    and Kruskal's Algorithm, Shortest Path Algorithms: Dijkstra,
    Bellman-Ford, Topological Sorting, Applications: Network Routing,
    Dependency Resolution
3. 4. Hashing: Hash functions, Collision resolution: Linear probing,
     Quadratic probing, Double hashing, Separate chaining, Applications:
     Symbol tables, Hash Maps
3. 5. Advanced Data Structures: Segment Trees and Fenwick Trees (Binary
     Indexed Trees, Disjoint Set Union (Union-Find), Skip Lists, Suffix
     Trees
3. 6. Applications and Case Studies: Data structure use in real-world systems,
    Algorithmic applications using data structures, problem-solving with
    data structures

Module 4: DBMS

4.1 Introduction to DBMS
4.2 Entity-Relationship (ER) and Enhanced ER Models
4.3 Relational Model and Relational Algebra
4.4 SQL and Advanced SQL
4.5 Database Design and Normalization
4.6 Transaction Management
4.7 Storage and Indexing
4.8 Query Processing and Optimization
4.9 Distributed Databases

Module 5: Computer Organization and Architecture

5.1 Data representation, addressing modes and instruction formats
5.2 Processor design and control unit
5.3 Memory hierarchy (cache, virtual, DRAM, SRAM, ROM etc)
5.4 Memory management techniques
5.5 Interleaved and associative memory
5.6 I/O systems (devices, interfaces, interrupts, DMA, I/O data transfer methods etc.)
5.7 Advanced Architectural Models (RISC, CISC, Vector processor etc.)
5.8 Parallelism and Multicore Architecture
5.9 Performance and Optimization

Module 6: Basics of Machine learning and AI

6.1 Basic Foundations of AI and ML (i.e. definitions, approaches & applications
6.2 Supervised vs Unsupervised Learning
6.3 Ensemble methods in Machine Learning
6.4 Probabilistic models and inference
6.5 Neural networks and deep learning
6.6 Reinforcement learning
6.7 AI tools and Frameworks
6.8 Ethics, Fairness & Explainability in AI

Module 7: Software Engineering

7.1 Software Development Life Cycle (SDLC) Models
7.2 Software Requirements
7.3 Software Design Principles
7.4 Modularity
7.5 Cohesion
7.6 Testing and Quality Assurance
7.7 Software Metrics and Measurement
7.8 Software Maintenance

Module 8: Probability and Statistics

8.1 Properties of Probability
8.2 Random Variables

8.3 Experimental Probability
8.4 Theoretical Probability
8.5 Axiomatic Probability
8.6 Probability without Replacement
8.7 Sample Space
8.8 Types of Events

Suggested Readings:

1. Artificial Intelligence: A Modern Approach by Stuart Rusell and Peter Norvig
2. Machine Learning: A Probabilistic Perspective by Kevin P. Murphy
3. "Data Structures and Algorithms in C++" by Adam Drozdek
4. "Introduction to Algorithms" by Cormen, Leiserson, Rivest, and Stein (CLRS)
5. "Data Structures and Algorithm Analysis in C" by Mark Allen Weiss
6. "Database System Concepts" by Silberschatz, Korth, Sudarshan
7. "Fundamentals of Database Systems" by Elmasri & Navathe
8. "Database Management Systems" by Raghu Ramakrishnan and Johannes Gehrke

Weblinks
1. https://youtu.be/Ok-xpKjKp2g?si=lIvwkHzL_djrRr4F
2. How do AI and machine learning intersect, and what are the applications where they complement each other? | by AlgoTutor Academy | Medium