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Syllabus for Ph.D Entrance Examination
Department Of Computer Science and Applications
Paper Ii: Computer Science and Applications

Unit 1: Discrete Structures and Optimization

- Mathematical Logic: Truth tables, logical operations, propositions
- Sets and Relations: Operations, properties, functions
- Graph Theory: Paths, trees, connectivity, coloring
- Optimization: Linear programming problems
- Counting, Mathematical Induction, and Discrete Probability

Unit 2: Computer System Architecture

- Digital Logic Circuits: Gates, flip-flops, registers
- Data Representation: Number systems, binary coding
- Basic Computer Organization: CPU, memory, I/O
- Register Transfer and Micro-operations
- Micro-programmed Control

Unit 3: Programming Languages and Computer Graphics

- Language Design: Syntax, semantics, compilation
- Elementary Data Types: Variables, constants, expressions
- Object-Oriented Programming: Classes, inheritance, polymorphism
- 2D Graphics: Transforms, viewing, clipping
- 3D Graphics: Object representation, transformations

Unit 4: Database Management Systems

- Database Concepts: Models, schemas, architecture
- SQL: Queries, joins, views
- Data Warehousing and Data Mining
- Normalization: Normal forms, dependencies
- NoSQL Databases

Unit 5: System Software and Operating System

- System Software: Assemblers, loaders, linkers
- Operating Systems Basics: Types, functions
- Threads and CPU Scheduling
- Process Management: Creation, synchronization, deadlocks
- Storage Management: Memory allocation, virtual memory

Unit 6: Software Engineering

- Software Process Models: Waterfall, agile, spiral

- Software Design: Principles, patterns, UML
- Project Estimation and Scheduling
- Configuration Management: Version control, change management
- Software Quality: Testing methods, quality metrics

Unit 7: Data Structures and Algorithms

- Algorithm Analysis: Time and space complexity
- Data Structures: Arrays, linked lists, stacks, queues, trees
- Graph Algorithms: Shortest path, minimum spanning tree
- Complexity Theory: P, NP problems
- Advanced Algorithms: Dynamic programming, greedy methods

Unit 8: Theory of Computation and Compilers

- Theory of Computation: Automata, formal languages
- Context-Free Languages: Grammars, parsing
- Computational Complexity: Decidability, tractability
- Regular Language Models: Finite automata, regular expressions
- Compilers: Lexical analysis, parsing, code generation

Unit 9: Data Communication and Computer Networks

- Data Communication: Basics, transmission media
- World Wide Web: HTTP, HTML, browsers
- OSI and TCP/IP Layers: Protocols, functions
- Mobile Technology: Wireless networks, protocols
- Network Security: Encryption, authentication, firewalls

Unit 10: Artificial Intelligence

- Artificial Neural Networks: Structure, learning algorithms
- Genetic Algorithms: Selection, crossover, mutation
- Natural Language Processing: Parsing, understanding
- Knowledge Representation: Logic, semantic networks
- Multi-Agent Systems: Cooperation, coordination

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- **Programming:**
  - "Computer Systems: A Programmer's Perspective", Randal E. Prentice Hall
  - "Java: The Complete Reference, 8th Edition", Herbert Schildt. McGraw Hill
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  - "Fundamentals of Database Systems" – Ramez Elmasri and Shamkant B Navathe, Pearson Publications.
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- **Software Engineering:**
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  - Lan SommerVille, "Software Engineering", Eigith Edition, Pearson Education, 2009.
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- **Compiler Design:** "Principles of Compiler Design" by Aho and Ullman. Narosa Publishing House
- **Digital Logic:** "Digital Logic and Design" by Morris Mano. Pearson Education, Prentice Hall
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  - "Fundamentals of Data Structure in C" – Ellis Horowitz and Sartaj Sahni, University Press.
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  - "Introduction to the Design and Analysis of Algorithms" – Anany Levitin, Pearson Education.
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  - "Machine Learning: The Art and Science of Algorithms that makes sense of Data" – Peter Flach, Cambridge University Press.
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