

**Department of computer science  
Cochin University of Science and Technology**

**Syllabus for Department Admission Test (DAT)-2019  
for MTech & PhD Programmes**

**[for PhD candidates only]**

**Research Methodology:** Objectives and types of research, types of research, research formulation, literature review, hypothesis, research design and methods, research plan, data collection and analysis, methods of data collection, statistical data analysis, hypothesis testing, reporting and thesis writing, bibliography and referencing, ethical issues, copyright, IPR, patent law, plagiarism, citation, journal metrics

**[for both MTech and PhD candidates]**

**Discrete Mathematics:** Propositional and first order logic. Sets, relations, functions, partial orders and lattices. Groups. Graphs: connectivity, matching, coloring. Combinatorics: counting, recurrence relations, generating functions. **Linear Algebra:** Matrices, determinants, system of linear equations, eigenvalues and eigenvectors, LU decomposition. **Calculus:** Limits, continuity and differentiability. Maxima and minima. Mean value theorem. Integration. **Probability:** Random variables. Uniform, normal, exponential, poisson and binomial distributions. Mean, median, mode and standard deviation. Conditional probability and Bayes theorem.

**Computer Organization and Architecture:** Machine instructions and addressing modes. ALU, data path and control unit. Instruction pipelining. Memory hierarchy: cache, main memory and secondary storage; I/O interface (interrupt and DMA mode).

**Programming and Data Structures:** Programming in C. Recursion. Arrays, stacks, queues, linked lists, trees, binary search trees, binary heaps, graphs. **Algorithms:** Searching, sorting, hashing. Asymptotic worst case time and space complexity. Algorithm design techniques: greedy, dynamic programming and divide and conquer. Graph search, minimum spanning trees, shortest paths.

**Theory of Computation:** Regular expressions and finite automata. Context-free grammars and push-down automata. Regular and context-free languages, pumping lemma. Turing machines and undecidability. **Compiler Design:** Lexical analysis, parsing, syntax-directed translation. Runtime environments. Intermediate code generation.

**Operating System:** Processes, threads, inter process communication, concurrency and synchronization. Deadlock. CPU scheduling. Memory management and virtual memory. File systems. **Databases:** ER model. Relational model: relational algebra, tuple calculus, SQL, Integrity constraints, normal forms. File organization, indexing (e.g., B and B+ trees), Transactions and concurrency control.

**Computer Networks:** Concept of layering. LAN technologies (Ethernet). Flow and error control techniques, switching. IPv4/IPv6, routers and routing algorithms (distance vector, link state). TCP/UDP and sockets, congestion control. Application layer protocols (DNS, SMTP, POP, FTP, HTTP). Basics of Wi-Fi. **Network security:** authentication, basics of public key and private key cryptography, digital signatures and certificates, firewalls.