**Following shall be the course contents for the Eligibility Test for Ph.D. in Computer Science & Engineering**

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| **Contents** |
| **Discrete Mathematics and Probability**  Propositional and first order logic. Sets, relations, functions, partial orders and lattices. Groups. Graphs: connectivity, matching, coloring. Combinatorics : counting, recurrence relations, generating functions. Probability: Random variables. Uniform, normal, exponential, poisson and binomial distributions. Mean, median, mode and standard deviation. Conditional probability and Bayes theorem. |
| **Digital Logic and Boolean Algebra.**  Combinational and sequential circuits. Boolean Algebra Minimization. Number representations and computer arithmetic (fixed and floating point). |
| **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/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 contex-free languages, pumping lemma. Turing machines and undecidability. |
| **Compiler Design**  Lexical analysis, parsing, syntax-directed translation. Runtime environments. Intermediate code generation, optimization. |
| **Operating System and System Software**  Processes, threads, inter‐process communication, concurrency and synchronization. Deadlock. CPU scheduling. Memory management and virtual memory. File systems. Distributed operating System. System Software: linker, loader and interpreter. |
| **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. Distributed databases. |
| **Computer Networks and Network Security**  Concept of layering.LAN technologies. Flow and error control techniques, switching. IPv4/IPv6, routers and routing algorithms. TCP/UDP and sockets, congestion control. Application layer protocols. Network security: authentication, public key and private key cryptography, digital signatures and certificates, firewalls. Mobile and wireless communication network. |
| **Software Engineering**  Software development models, required analysis, software architecture, design, coding, testing maintenance, project planning estimation. |
| **Data Science**  Data warehouse, data mining, Big data and Predictive Analytics. |
| **Artificial Intelligence**  Knowledge representation and its uses, Artificial Neural Network, fuzzy logic and genetic algorithm. Machine learning. |