Ph.D Entrance Syllabus
Computer Science and Engineering

Digital Logic - Boolean algebra, Combinational and sequential circuits, 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, pipeline hazards
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 traversals, 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, Local optimization, Data flow analyses: constant propagation, liveness analysis, common subexpression elimination

Operating System - System calls, processes, threads, inter-process communication, concurrency and synchronization, Deadlock, CPU and I/O 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: OSI and TCP/IP Protocol Stacks, Basics of the packet, circuit and virtual circuit switching
Datalink layer: framing, error detection, Medium Access Control, Ethernet bridging, Routing protocols: shortest path, flooding, distance vector and link-state routing

Fragmentation and IP addressing, IPv4, CIDR notation, Basics of IP support protocols (ARP, DHCP, ICMP), Network Address Translation (NAT), Transport layer: flow control and congestion control, UDP, TCP, sockets, Application layer protocols: DNS, SMTP, HTTP, FTP, Email