

**Syllabus of Entrance Test for Admission to Ph.D.  
Preparatory Coursework and M.Phil.  
in  
Computer Science and Application**

**Conducted by**

**Department of Computer Science and Application  
University of North Bengal**



There will be two papers as follows.

<b>Paper ID</b>	<b>Paper Name</b>	<b>Duration of the Test</b>	<b>No. of Question</b>	<b>Marks</b>	<b>Type of Exam</b>
<b>Paper-I</b>	Research Methodology	30 Minutes	25	50	MCQ
<b>Paper-II</b>	Computational Technologies	30 Minutes	25	50	MCQ

### **Paper-I: Research Methodology**

Research: Meaning, characteristics and types; steps of research; methods of research, research ethics, papers, article, workshop, seminar, conferences, symposium, Thesis writing: its characteristics and format.

### **Paper-II: Computational Technologies**

#### **Section1: Computational Mathematics**

**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.

#### **Section 2: Digital Logic**

Boolean algebra, Combinational and sequential circuits, Minimization, Number representations and computer arithmetic (fixed and floating point)

#### **Section 3: 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).

#### **Section 4: Programming and Data Structures**

Programming in C; Recursion, Arrays, stacks, queues, linked lists, trees, binary search trees, binary heaps, graphs.

#### **Section 5: 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.

#### **Section 6: 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

#### **Section 7: Compiler Design**

Lexical analysis, parsing, syntax-directed translation; Runtime environments; Intermediate code generation

#### **Section 8: Operating System**

Processes, threads, inter-process communication, concurrency and synchronization; Deadlock, CPU scheduling, Memory management and virtual memory, File systems

**Section 9: 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

**Section 10: 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.

**Section 11: Software Engineering**

Fundamentals of Software Engineering, SDLC Models, Requirement Engineering, System Design, Coding, Testing, System Maintenance, Project Management, Recent advances.