BEL Probationary Engineer (CSE) – Quick Notes

1■■ DATA STRUCTURES & ALGORITHMS
Complexity: O(1) Arrays, Linked Lists, Stack (LIFO), Queue (FIFO), Trees (BST, AVL, Heap), Graphs (BFS, DFS, Dijkstra, Kruskal), Hashing, Searching (Linear/Binary), Sorting (Merge, Quick, Heap).
Divide & Conquer, Dynamic Programming, Greedy.

2■■ OPERATING SYSTEMS
Functions: Process, Memory, File Mgmt.
Process states: New→Ready→Running→Waiting→Terminated.
Scheduling: FCFS, SJF, SRTF, RR, Priority.
Synchronization: Semaphore, Deadlock, Banker's Algorithm.
Memory: Paging, Segmentation, Virtual Mem, Page Replacement (FIFO, LRU).
File Mgmt: Contiguous, Linked, Indexed.

3■■ DBMS
Keys: Primary, Candidate, Foreign, Composite.
Normalization: 1NF, 2NF, 3NF, BCNF.
SQL: SELECT, JOIN, GROUP BY, HAVING.
ACID Properties. Concurrency: Locks, Deadlocks.
Indexing: B+ Tree, Primary/Secondary.

4■■ COMPUTER NETWORKS
OSI Layers (7): Physical→Application.
Devices: Hub, Switch, Router.
Protocols: HTTP, FTP, SMTP, DNS, ARP.
Routing: RIP, OSPF.
IPV4, IPV6, Subnetting.
Error/Flow control: CRC, Sliding Window.

5■■ COMPUTER ORGANIZATION
CPU = ALU + CU + Registers.
Memory hierarchy: Reg→Cache→RAM→Disk.
Addressing modes: Immediate, Direct, Indirect.
Pipelining & Hazards.
Cache mapping: Direct, Associative.
DMA, Interrupts.

6■■ THEORY OF COMPUTATION / COMPILER
Finite Automata (DFA/NFA), CFG, PDA, Turing Machine.
Compiler Phases: Lexical→Syntax→Semantic→ICG→Optimization→CodeGen.
Parsing: LL, LR.

7■■ PROGRAMMING (C/C++)
Data types, Operators, Loops, Arrays, Strings.
Pointers, Functions (recursion).
Struct vs Union.
OOP: Class, Object, Inheritance, Polymorphism, Encapsulation.

8■■ APTITUDE & REASONING
Formulas: SI=(P×R×T)/100, CI=P(1+R/100)^T−P, nPr=n!/(n−r)!, nCr=n!/[r!(n−r)!].
Speed=Distance/Time, Profit%, Loss%.
Reasoning: Blood relation, Coding-Decoding, Syllogism.
English: Synonyms, Antonyms, Grammar, Comprehension.

9■■ GENERAL AWARENESS
BEL, DRDO, ISRO projects.
Awards, Days, Defence, Economy, Schemes, Science & Tech.
Focus: Electronics & Defence updates.