

SYLLABUS FOR SSB

1. DISCRETE STRUCTURES

Propositional Logic, Predicate calculus, Sets, Relations, Functions, Inclusion-Exclusion Principle, Equivalence and Partial Orderings, Elementary Counting Techniques.

Computability: Models of computation- Finite Automata, Pushdown Automata, Non-determinism and NFA, DPDA and PDAs and Languages accepted by these structure, Grammars, Languages, Non-computability and Examples of non-computable problems.

Graph: Definition, walks, paths, trails, connected graphs, regular and bipartite graphs, cycles and circuits. Tree and rooted tree, Spanning trees, Eccentricity of a vertex radius and diameter of a graph, central Graphs, Centers of a tree, Hamiltonian and Eulerian graphs, Planar graphs, Graph Coloring.

Groups: Finite fields and Error correcting/ detecting codes.

2. COMPUTER ARITHMETIC

Logic Families: TTL, ECL, and C-MOS gates, Boolean algebra and Minimization of Boolean functions, Flip-flops-types, race condition and comparison, Design of combinational and sequential circuits.

Representation of Integers: Octal, Hexadecimal, Decimal, and Binary , 2's complement and 1's complement arithmetic, Floating point representation.

Arithmetic : Addition and subtraction of signed Numbers, Design of Fast Adders, Multiplication of positive Numbers, Signed-operand multiplication , Fast multiplication, Integer Division, Floating- point Numbers, (IEEE754 s...) and operations.

3. PROGRAMMING IN C AND C++

Programming in C: Elements of C- Tokens, identifiers, data types in C, Control structures in C, Sequence, selection and iterations, Structured data types in C-arrays, structure, union, string and pointers.

Object Oriented Programming Concepts: Class, object, instantiation, Inheritance. Polymorphism and Overloading.

C++ Programming: Elements of C++ - Tokens, identifiers, Variables and constants, Data types, Operators, Control statements, Functions parameter passing, Class and objects, Constructors and destructors, Overloading, Inheritance, Template, Exception handling.

4. RELATIONAL DATABASE DESIGN AND SQL

ER diagrams and their transformation to relational design, normalization – 1NF, 2NF, 3NF, BCNF, 4NF. Limitations of 4NF and BCNF.

SQL: Data Definition Language (DDL), Data Manipulation Language (DML), Data Control Language (DCL) commands, Database objects like – Views, indexes, sequences, synonyms, data dictionary.

5. DATA AND FILE STRUCTURES

Data, Information, Definition of data structure, Arrays, stacks, queues, linked lists, trees, graphs, priority queues and heaps.

File Structures: Fields, records and files, Sequential, direct, index-sequential and relative files, Hashing, inverted lists and multi-lists, B trees and B⁺ trees.

6. COMPUTER NETWORKS

Network fundamentals: Local Area Networks (LAN), Metropolitan Area Networks (MAN), Wide Area Networks (WAN), Wireless Networks. Reference Models: The OSI model, TCP/IP model.

Data link control: Channel capacity, Transmission media - twisted pair, coaxial cables, fiber-optic cables, wireless

transmission – radio, microwave, infrared and millimeter waves, Light wave transmission, Telephones – local loop, trunks, multiplexing, switching, narrowband ISDN, broadband ISDN, ATM, High speed LANS, Cellular Radio, Communication satellites - geosynchronous and low-orbit, Switch/Hub, Bridge, Error detection and correction, Flow control.

Internetworking: Router, Gateways, Concatenated virtual circuits, Tunneling, Fragmentation, Firewalls. Routing: Virtual circuits and datagrams, Routing algorithms, Congestion control and avoidance, TCP Congestion management policy.

Cryptography and Protocols of network applications: Public key, secret key, Domain Name System (DNS) - Electronic Mail and World Wide Web (WWW), The DNS, Resource Records, Name servers, E-mail-architecture and Servers, Web server, HTTP.

7. SYSTEM SOFTWARE AND COMPILERS

Assembly language fundamentals (8085 based assembly language programming). Assemblers – 2-pass and single-pass, Macros and macro processors.

Loading, linking, relocation, program relocatability, Linkage editing.

Text editors, Programming Environments, Debuggers and program generators.

Compilation and Interpretation, Bootstrap compilers, Phases of compilation process, Lexical analysis, Lex package on UNIX SYSTEM.

Context free grammars, Parsing and parse trees, Presentation of parse (derivation) trees as rightmost and leftmost derivation, Bottom up parsers – shift-reduce, operator precedence, and LR, YACC package on UNIX system.

Top down parsers – left recursion and its removal, Recursive descent parser, Predictive parser, Intermediate codes – Quadruples, Triples, Intermediate code generation, Code generation, Code optimization.

8. OPERATING SYSTEMS

Main functions of operating systems, Multiprogramming, Multiprocessing, and Multitasking.

Memory Management: Virtual Memory, Paging, Fragmentation.

Concurrent Processing: Mutual exclusion, Critical regions, lock and unlock.

Scheduling: CPU scheduling, I/O scheduling, Resource scheduling, Deadlock and scheduling algorithms, Banker's algorithm for deadlock handling.

UNIX

The Unix System: File system, process management, bourne shell, shell variables, command line programming.

Filters and Commands: Pr, head, tail, cut, paste, sort, uniq, tr, join, etc., grep, egrep, fgrep, etc., sed, awk, etc.

System Calls (like): Create, open, close, read, write, lseek, link, unlink, stat, fstat, unmask, chmod, exec, fork, wait, system.