

INFORMATION TECHNOLOGY SPECILISATION SCHOOL, INS VALSURA
SYLLABUS FOR ENTRANCE EXAM (OFFICERS)

This document pertains to the syllabus to be covered by candidates appearing for the entrance exam for Officers' Course of ITSS. The listed topics need to be covered **broadly** in an analytical manner with focus on the '**whys**' behind the facts. The suggested Books of Reference are mostly exhaustive resources and selective reading of the listed topics is considered sufficient. Candidates may not restrict to the suggested Books of Reference till the time the listed topics are well understood from the resource of their choice.

Entrance exam will comprise of a screening test (containing objective type questions) followed by an interview for candidates who attain acceptable grades in the screening test.

Any queries/suggestions are welcome at pdinsvalsura@nic.in.

1. Computer Architecture

Books/Sites of Reference:-

- 1.A Structured Computer Organisation by Andrew S Tanenbaum
- 1.B <http://www.anandtech.com>
- 1.C <http://www.tomshardware.com>

Topics to be Covered:-

- 1.1 History of Computing
 - 1.1.1 Generation of Computers
 - 1.1.2 Moore's Law
 - 1.1.3 History of x86 Architecture and Desktop PCs
- 1.2 Processors
 - 1.2.1 Internals of CPU
CU, ALU
 - 1.2.2 Registers
Accumulator, PC, SP etc.
 - 1.2.3 Code Execution
Fetch, Decode, Data Input and Execute
 - 1.2.4 Parallelism
Processor and Instruction Level
 - 1.2.5 RISC and CISC
- 1.3 Memory Hierarchy and Organisation
 - 1.3.1 Addressing
 - 1.3.2 Caching
- 1.4 Primary Memory
 - 1.4.1 Volatile
SRAM, DRAM
 - 1.4.2 Non-volatile
ROM, PROM, EPROM, EEPROM, Flash

- 1.5 Secondary Memory
 - 1.5.1 Magnetic Storage
 - 1.5.2 Optical Storage
 - 1.5.3 Magnetic Tape
 - 1.5.4 Hard Disk
 - 1.5.5 CD/DVD-ROM
 - 1.5.6 Storage Interfaces
IDE, SCSI, SATA, SAS
 - 1.5.7 RAID Technologies
 - 1.5.8 Solid State Disks
- 1.6 IO Technologies
 - 1.6.1 Buses
PCI, PCI-Express
 - 1.6.2 Ports
Parallel, Serial, USB, Fire wire
 - 1.6.3 Display Interfaces
RGB, DVI
- 1.7 Modern Computer Architecture
 - 1.7.1 Intel Core 2 Architecture
MCH, ICH, FSB
 - 1.7.2 AMD Athlon 64 Architecture
Hyper Transport
 - 1.7.3 Intel Nehalem Architecture
Quick Path Interconnect
- 1.8 General Knowledge on Latest PC/Server Hardware
 - 1.8.1 Differences between Server and Desktop Hardware

2. Data Structures and Algorithms

Books of Reference:-

- 2.A Data Structures by Seymour Lipschutz

Topics to be Covered:-

- 2.1 Basics of Algorithms
 - 2.1.1 Complexity of Algorithms
 - 2.1.2 Recursive Algorithms
 - 2.1.3 Variables and Data Types
- 2.2 String Processing
- 2.3 Linear Arrays
 - 2.3.1 Representation in Memory
 - 2.3.2 Traversal
 - 2.3.3 Insertion and Deletion
- 2.4 Multi-dimensional Arrays
- 2.5 Linked Lists
 - 2.5.1 Representation in Memory
 - 2.5.2 Traversal
 - 2.5.3 Insertion and Deletion
- 2.6 Stacks and Queues
 - 2.6.1 Representation in Memory
 - 2.6.2 Use for Recursive Procedures
- 2.7 Trees
 - 2.7.1 Binary Trees
 - 2.7.2 Representation in Memory
 - 2.7.3 Traversal
- 2.8 Searching and Sorting Algorithms
 - 2.8.1 Linear Search
 - 2.8.2 Binary Search
 - 2.8.3 Bubble Sort
 - 2.8.4 Insertion Sort
 - 2.8.5 Quick Sort

3. Operating Systems

Books of Reference:-

- 3.A Modern Operating Systems by Andrew S Tanenbaum
- 3.B Operating System Concepts by Abraham Silberschatz, Peter Baer Galvin and Greg Gagne

Topics to be Covered:-

- 3.1 Operating System Structures
- 3.2 Processes
 - 3.2.1 Process Creation
 - 3.2.2 Process Termination
 - 3.2.3 Process States
- 3.3 Threads
 - 3.3.1 Thread Model
 - 3.3.2 Thread Usage
- 3.4 Inter-process Communication
- 3.4 CPU Scheduling
- 3.5 Process Synchronisation

- 3.6 Deadlocks (Basics)
- 3.7 Memory Management
 - 3.7.1 Paging
 - 3.7.2 Virtual Memory
 - 3.7.3 Swapping
- 3.8 Input/Output Management
 - 3.8.1 Programmed Input/Output
 - 3.8.2 Direct Memory Access
 - 3.8.3 Interrupt Driven Input/Output Interrupt Handlers
 - 3.8.4 Device Drivers
- 3.9 File System
 - 3.9.1 File Naming, Structure, Types, Access and Attributes
 - 3.9.2 File Operations
 - 3.9.3 Directories
 - 3.9.4 File System Layout
 - 3.9.5 Disk Space Management

4. Computer Networking

Books of Reference:-

- 4.A Computer Networks by Larry L Peterson and Bruce S Davie
- 4.B Computer Networks by Andrew S Tanenbaum

Topics to be Covered:-

- 4.1 Definition of Computer Networking
 - 4.1.1 Bandwidth and Latency
- 4.2 Classification of Computer Network
 - 4.4.1 Topology
 - Star, Mesh, Tree, Bus, Ring etc.
 - 4.4.2 Type/Size
 - PAN, LAN, CAN, MAN, WAN etc.
- 4.3 Layering in Networks
 - 4.2.1 Need
 - 4.2.2 Concept
 - 4.2.3 Advantages
- 4.4 Seven Layer OSI Model of Networking
 - 4.4.1 Functionality of each layer
- 4.6 The Internet
 - 4.6.1 IETF and RFCs
 - 4.6.2 TCP/IP Model of Networking
- 4.7 Physical Layer
 - 4.7.1 Physical Medium
 - Co-axial, Twisted Pair, Fibre, Wireless

- 4.7.2 Modulation and Encoding
- 4.7.3 Physical Layer of Ethernet
Co-axial, Twisted Pair
- 4.8 Data Link Layer
 - 4.8.1 Framing
Bit-level, Byte-level
Bit-stuffing, Byte-stuffing
 - 4.8.2 Error Detection/Correction
 - 4.8.3 Framing in Ethernet
- 4.9 MAC Sub-layer
 - 4.9.1 Multiple Access Techniques
CSMA-CD, CSMA-CA
Token Ring
 - 4.9.3 ALOHA
 - 4.9.4 MAC in Ethernet
- 4.10 Network Layer
 - 4.10.1 Hierarchical Addressing
 - 4.10.2 Circuit Switching and Packet Transfer
 - 4.10.3 Types of Routing
Fixed, Source, Dynamic
 - 4.10.4 Basics of Routing Protocols
Distance Vector, Link State
 - 4.10.5 Internet Protocol v4
 - 4.10.6 Subnet and Gateway
 - 4.10.7 Classless Inter-domain Routing
 - 4.10.8 DHCP, ARP and RARP
- 4.11 Transport Layer
 - 4.11.1 Multiplexing
 - 4.11.2 Reliability using Acknowledgements
 - 4.11.3 Sliding Window Protocol
 - 4.11.4 TCP and UDP
Concept of Ports
 - 4.11.5 Connections in TCP
- 4.12 Application Layer
 - 4.12.1 DNS
 - 4.12.2 Electronic Mail
 - 4.12.3 World Wide Web
 - 4.12.4 FTP

5. Software Programming

Books of Reference:-

- 5A. Object Oriented Programming in C++ by Robert Lafore
- 5B. Java by Example by Jerry R Jackson and Alan McClellan

Topics to be Covered:-

- 5.1 Writing Pseudo Code
- 5.2 Flowcharts
- 5.3 Concepts of Object Oriented Programming
- 5.4 Knowledge of any Programming Languages. Preferably following:-
 - 5.4.1 C
 - 5.4.2 C++
 - 5.4.3 Java
- 5.5 Ability to Code Small Problems like Sorting Algorithms from the Command Prompt (not through an IDE)
 - 5.5.1 Programming on Linux
 - 5.5.2 Programming on Windows

6. Information Security

Books of Reference:-

- 6A. Network Security by Charlie Kaufman, Radia Perlman and Mike Speciner

Topics to be Covered:-

- 6.1 The CIA Model of Information Security
 - 6.1.1 Confidentiality
 - 6.1.2 Integrity
 - 6.1.3 Availability
 - 6.1.4 Non Repudiation
- 6.2 Shared Key Cryptography
- 6.3 Public Key Cryptography
 - 6.3.1 Public Key Infrastructure
 - 6.3.2 Digital Certificates
- 6.4 Block Ciphers
- 6.5 Stream Ciphers
- 6.4 Hashing
- 6.5 Private Communication
 - 6.5.1 Tunnelling / Virtual Private Network
 - 6.5.2 Session Keys
- 6.6 Key Escrow
- 6.7 Authentication Mechanisms
 - 6.7.1 Password Based
 - 6.7.2 Address Based
- 6.8 Firewalls
 - 6.8.1 Packet Filtering
 - 6.8.2 Application Layer Gateways

7. Database Concepts

Books of Reference:-

7A. Database System Concepts by Abraham Silberschatz, Henry F Korth and S Sudarshan

Topics to be Covered:-

- 7.1 Database Systems
 - 7.1.1 Purpose
 - 7.1.2 Data Abstraction
- 7.2 Relational Databases
 - 7.2.1 Structure
 - 7.2.2 Relational Algebra
- 7.3 SQL
 - 7.3.1 Data Definition
 - 7.3.2 Basic Structure of SQL Queries
 - 7.3.3 SQL Data Types and Schemas
- 7.4 Entity Relationship Model
- 7.5 Normalisation

8. Digital Logic

Books of Reference:-

8A. Digital Logic and Computer Design by M Morris Mano

Topics to be Covered:-

- 8.1 Binary Systems
 - 8.1.1 Digital Computers and Systems
 - 8.1.2 Binary Numbers
 - 8.1.3 Number Base Conversion Binary, Octal, Decimal, Hexadecimal
 - 8.1.4 Complements
 - 8.1.5 Binary Codes Binary Coded Decimal
 - 8.1.6 Binary Storage
 - 8.1.7 Binary Logic
- 8.2 Boolean Algebra
 - 8.2.1 Basic Theorems and Properties
 - 8.2.2 Boolean Functions
 - 8.2.3 Logical Operations
- 8.3 Digital Logical Gates
- 8.4 Basics of Probability and Statistics
- 8.5 Basic of Permutations and Combinations (Combitronics)

9. Linux and Windows

General References

Topics to be Covered:-

- 9.1 Linux Operating System
 - 9.1.1 Installation (of any latest flavour)
 - 9.1.2 Installation of Applications
 - 9.1.3 Exploitation of Command Line Interface
- 9.2 Windows Operating System
 - 9.2.1 Installation (of any version)
 - 9.2.2 Installation of Applications
 - 9.2.3 Registry Editing