

# Syllabus for Subject of Computer Science for NTS / PPSC

Paper A

Total Marks 100

## Section A

### Introduction to Computing:

- ✓ Number Systems
- ✓ Binary numbers
- ✓ Boolean logic
- ✓ History Computer system
- ✓ Basic machine organization
- ✓ Von Neumann Architecture
- ✓ Algorithm definition
- ✓ Design and implementation
- ✓ Programming paradigm & Language
- ✓ Graphical programming
- ✓ Overview of SE & IT
- ✓ Operating system
- ✓ Compiler
- ✓ Computer networks and Internet
- ✓ Computer graphics, AI, Social and legal issues.

### Programming Solving Techniques:

- ✓ Algorithms and problem solving
- ✓ Development of basic Algorithms
- ✓ Analyzing problem
- ✓ Designing solution
- ✓ Testing designed solution
- ✓ Fundamental programming constructs
- ✓ Translation of algorithms to programmes
- ✓ Data types
- ✓ Control structures
- ✓ Functions
- ✓ Arrays
- ✓ Records
- ✓ Files
- ✓ Testing programmes

## Section B

### Computer Communications & Networks:

- ✓ Analogue and digital Transmission
- ✓ Noise
- ✓ Media
- ✓ Encoding
- ✓ Asynchronous and Synchronous transmission
- ✓ Protocol design issues
- ✓ Network System architecture (OSI, TCP/IP)
- ✓ Error control
- ✓ Flow Control
- ✓ Data Link Protocols (HDLC,PPP)
- ✓ Local Area Networks & MAC Layer protocols (Ethernet, Token ring)
- ✓ Multiplexing
- ✓ Switching and IP Networks
- ✓ Internetworking
- ✓ Routing
- ✓ Bridging
- ✓ Transport layer protocols TCP/IP, UDP
- ✓ Network security issues
- ✓ Programming exercises or projects involving implementation of protocols at different layers

**Digital Logic & Computer Architecture:**

- ✓ Logic design of Digital Systems
- ✓ Fundamental and advanced concepts of Logic Designs
- ✓ Boolean Algebra & functions
- ✓ Designing and implementation of combinational and Sequential logic
- ✓ Minimization techniques
- ✓ Number representation and basic binary arithmetic
- ✓ Logic families and digital integrated circuits
- ✓ Use of CAD tools for logic designs
- ✓ Topics of Computer Architecture

**Section C****Operating Systems:**

- ✓ History and Goals
- ✓ Evolution of multi-user systems
- ✓ Process and CPU management
- ✓ Multithreading
- ✓ Kernel and User Modes
- ✓ Protection
- ✓ Problems of cooperative processes
- ✓ Synchronization
- ✓ Deadlocks
- ✓ Memory management and virtual memory
- ✓ Relocation
- ✓ External Fragmentation
- ✓ Paging and Demand Paging
- ✓ Secondary storage
- ✓ Security and Protection
- ✓ File systems
- ✓ I/O systems
- ✓ Introduction to distributed operating systems
- ✓ Scheduling, dispatch and Introduction to concurrency

**Paper B****Total Marks 100****Section A****Theory of Automata and Formal Languages:**

- ✓ Finite State Models
- ✓ Language definitions preliminaries
- ✓ Regular expressions/Regular languages
- ✓ Finite automatas (FAs)
- ✓ Transition graphs (TGs)
- ✓ NF As, kleene's theorem
- ✓ Transducers (automata with output)
- ✓ Pumping lemma and non regular language Grammars and PDA
- ✓ Context free grammars
- ✓ Derivations
- ✓ Derivation trees and ambiguity
- ✓ Simplifying CFLs
- ✓ Normal form grammars and parsing
- ✓ Push-down Automata
- ✓ Pumping lemma and non-context free languages
- ✓ Decidability
- ✓ Chomsky's hierarchy of grammars
- ✓ Turing Machines Theory
- ✓ Turing machines
- ✓ Post machine
- ✓ Variations on 1M, 1M encoding
- ✓ Universal Turing Machine
- ✓ Context sensitive Grammars
- ✓ Defining Computers by TMs

**Compiler Theory & Design:**

- ✓ Compiler techniques and methodology
- ✓ Organization of compilers
- ✓ Lexical and syntax analysis
- ✓ Parsing techniques
- ✓ Object code generation and optimization
- ✓ Detection and recovery from errors
- ✓ Comparison between compilers and interpreters

**Numerical Methods:**

- ✓ Mathematical Preliminaries
- ✓ Solution of Equations in one variable
- ✓ Interpolation and Polynomial Approximation
- ✓ Numerical Differentiation and Integration
- ✓ Initial Value Problems for Ordinary Differential Equations
- ✓ Direct Methods for Solving Linear Systems
- ✓ Iterative Techniques in Matrix Algebra
- ✓ Solution of non-linear equations
- ✓ Approximation Theory
- ✓ Eigenvalues and Eigenvector computation

**Section B:****Data Base Systems**

- ✓ Basic database concepts
- ✓ Entity Relationship modelling
- ✓ Relational data model and algebra
- ✓ Structured Query language
- ✓ RDBMS
- ✓ Database design
- ✓ Functional dependencies and normal forms
- ✓ Transaction processing and optimization concepts
- ✓ Concurrency control and recovery techniques
- ✓ Database recovery techniques
- ✓ Database security and authorization
- ✓ Small Group Project implementing a database
- ✓ Physical database design
- ✓ Storage and file structure
- ✓ Indexed files
- ✓ Hashed files
- ✓ Signature files
- ✓ B-trees
- ✓ Files with dense index
- ✓ Files with variable length records
- ✓ Database efficiency and tuning Data Warehousing and Data Mining
- ✓ Emerging Database Technologies and Applications

**Software Engineering:**

- ✓ Process Models
- ✓ Software verification and validation
- ✓ Techniques are introduced to evaluate software correctness
- ✓ Efficiency
- ✓ Performance and reliability
- ✓ Integration of these techniques into a verification and validation plan
- ✓ Technical reviews
- ✓ Software testing
- ✓ Programming verification
- ✓ Prototyping and requirement tracing
- ✓ Attitude of industry toward reliability and performance

## Section C

### Artificial Intelligence:

- ✓ Introduction to Common Lisp
- ✓ AI classical system
- ✓ General Problem Solver
- ✓ Rules
- ✓ Simple search
- ✓ Means-ends analysis
- ✓ ELIZA
- ✓ Pattern matching
- ✓ Rule based translators
- ✓ OPS-5
- ✓ Knowledge Representation
- ✓ Natural language
- ✓ Rules
- ✓ Productions
- ✓ Predicate logic
- ✓ Semantic networks
- ✓ Frames
- ✓ Objects
- ✓ Scripts
- ✓ Searching
- ✓ Depth first search
- ✓ Breadth first search
- ✓ Best first search
- ✓ Hill climbing
- ✓ Min-max search
- ✓ Symbolic Mathematics
- ✓ Student solving algebra problems
- ✓ Translating English equations
- ✓ Solving algebraic equations
- ✓ Simplification rules
- ✓ Rewrite rules
- ✓ Meta-rules
- ✓ Macsyma
- ✓ PRESS
- ✓ ATLAS
- ✓ Logic Programming
- ✓ Resolution
- ✓ Unification
- ✓ Horn-clause logic
- ✓ Prolog
- ✓ Prolog programming
- ✓ Sample case studies of shells and Knowledge Based Systems
- ✓ A brief appreciation of state of the art computational techniques like neural networks
- ✓ Genetic algorithm
- ✓ Fuzzy sets

### Computer Graphics:

- ✓ Graphics hardware
- ✓ Fundamental algorithms
- ✓ Applications of graphics
- ✓ Interactive graphics programming - graph plotting
- ✓ Windows and clipping, and segmentation
- ✓ Programming raster display systems
- ✓ panning and zooming
- ✓ Raster algorithms and software
- ✓ Scan-Converting lines
- ✓ Characters and circles
- ✓ Region filling and clipping
- ✓ Two and three dimensional imaging geometry and transformations
- ✓ Curve and surface design
- ✓ Rendering
- ✓ Shading
- ✓ Color and animatio