

**FURTHER DETAILS REGARDING MAIN TOPICS OF
PROGRAMME NO.1/2014 (Item No.13 & 14)**

**VOCATIONAL TEACHER IN
COMPUTER APPLICATION**

VOCATIONAL HIGHER SECONDARY EDUCATION

(CATEGORY NO.433/2012 & 434/2012)

PART .I QUESTIONS BASED ON TECHNICAL QUALIFICATION

MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE

Logics and Proofs: propositions, conditional propositions and logical equivalences, quantifiers, proofs resolution, mathematical induction, Fundamental principles of counting, pigeonhole principle, countable and uncountable sets, principle of inclusion and exclusion, derangements, equivalence relations and partitions, partial order, lattices and Boolean algebra, generating functions, recurrence relations, solution of recurrences.

Divisibility, gcd, prime numbers, fundamental theorem of arithmetic, Congruences, Fermat's theorem, Euler function, primality testing, solution of congruences, Chinese remainder theorem, Wilson's theorem Graphs, Euler tours, planar graphs, Hamiltonian graphs, Euler's formula, applications of Kuratowski's theorem, graph colouring, chromatic polynomials, trees, weighted trees, shortest path algorithms, spanning trees, the max-flow min-cut theorem.

ALGORITHMS

Framework for Algorithm analysis - Asymptotic notations - Iterating recurrences-Master Method-Analysis of algorithms: Sorting - Searching
Algorithm design techniques - Backtracking - Branch and bound - Divide-and-Conquer: sorting - median finding - Dynamic Programming: knapsack - LCS - Matrix chain multiplication - Optimal search trees-Scheduling problems - Greedy strategy: Set of intervals - Fractional knapsack- Huffmann coding Algorithms on graphs - BFS, DFS Dijkstra's algorithm for shortest path, Floyd's algorithm for all pairs of shortest paths, Kruskal's and Prim's algorithm for minimum spanning tree
NP Completeness: Matching - Search /Decision - SAT - Subset sum and Partition - Hamiltonian circuit -Reductions - Approximation algorithms for NP - Randomized algorithms.

OPERATING SYSTEMS

Operating system concepts: System calls - Operating System Structure. Processes - Inter Process

Communication - Race Conditions – critical Sections- Mutual Exclusion - Busy Waiting - Sleep And Wakeup -Semaphores - Monitors - Message Passing. Process Scheduling - First come First Served -Shortest Job First - Priority scheduling - Round Robin Scheduling - Multiple queues scheduling -Guaranteed scheduling - Two- level scheduling.

Memory management: Multiprogramming and memory usage - Swapping - multiprogramming with fixed and variable partitions - Memory management with bit maps, linked lists, Buddy system - Allocation of swap space.

File systems and Input/Output: Files - Directories - File system implementation - Security and Protection mechanisms.

Deadlocks: Conditions for deadlock- Deadlock detection and recovery- Deadlock avoidance – resource trajectories - safe and unsafe states - Banker's algorithms - Deadlock prevention: Two phase locking - Non-resource deadlocks - Starvation.

Case Studies: UNLX / LINUX, Windows Operating Systems

COMPUTATIONAL INTELLIGENCE

Artificial Intelligence: History and Applications, Production Systems, Structures and Strategies for state space search- Data driven and goal driven search, Depth First and Breadth First Search, DFS with Iterative Deepening, Heuristic Search- Best First Search, A* Algorithm, AO* Algorithm, Constraint Satisfaction, Using heuristics in games- Minimax Search, Alpha Beta Procedure Knowledge representation - Propositional calculus, discrete- time Markov Chains - Continuous Markov Chains- Birth- death processes.
Game Theory: The formation of two-person - Zero-sum games - Solving simple games, games with mixed strategies, Graphical solution Procedure, Solving by LP.
Inventory Theory: Inventory models - Deterministic periodic and continuous review models – Stochastic continuous review model.

COMPUTER BASED OPTIMIZATION

Linear programming: Model and Assumptions - Solving LPP - Simplex method - Duality theory – Dual simplex method - Sensitivity analysis - Transportation and assignment problems Integer Programming: Branch and bound Techniques - Binary Linear programming - Assignment & Travelling salesman problems - Dynamic programming: Deterministic and Probabilistic Dynamic programming
Queuing Model: Specification and measure of queuing systems - Structures of basic queuing systems -Definition and classification of stochastic processes, AI Representational Schemes- Semantic Nets, Conceptual Dependency, Scripts, Frames, Introduction to Agent based problem solving
Machine Learning- Symbol based and Connectionist, Social and Emergent models of learning, The Genetic Algorithm- Genetic Programming, Overview of Expert System Technology- Rule based Expert Systems, Introduction to Natural Language Processing.

COMPUTER NETWORKS

Network Architecture: ISO-OSI and TCP protocol stack - Internet Architecture - Performance factors -Connecting to a network: Links - Encoding - Framing - Error detection - Reliable transmission - Ethernet
Internetworking: Switching and bridging - Internet protocol - Routing Protocols - Multicast - MPLS - IPV6
End-to-End Protocols: UDP - TCP - TCP extensions - RPC - RTP
Congestion Control: Resource Allocation - TCP Congestion Control - Congestion avoidance - QoS
Application Protocols - Email - HTTP - Session Control - Naming Service - Network Management

OBJECT ORIENTED MODELLING AND DESIGN

Structural Modelling: Object Oriented Fundamentals, Basic structural Modeling, UML Model, Class Diagrams, Object Diagrams, Packages and Interfaces, Case Studies. Behavioural and architectural Modelling: Use Case Diagrams, Interaction Diagrams, State Chart Diagrams, Collaborations, Design Patterns, Component Diagrams, Deployment Diagrams, Case Studies Object oriented Testing
Methodologies: Implications of Inheritance on Testing, State Based Testing,

Adequacy and Coverage, Scenario Based Testing, Testing Workflow, Case Studies, Object Oriented Metrics

Components: Abuses of inheritance, danger of polymorphism, mix-in classes, rings of operations, class cohesion and support of states and behaviour, components and objects, design of a component, lightweight and heavyweight components, advantages and disadvantages of using components.

NUMBER THEORY AND CRYPTOGRAPHY

Divisibility, Division Algorithm, Euclidean Algorithm, Congruences, Complete Residue systems, Reduced Residue systems, Fermat's little theorem, Euler's Generalization, Wilson's Theorem, Chinese Remainder Theorem, Finite Fields, Primitive Roots - Primality Tests, Pseudoprimes, Carmichael Numbers, Fermat's pseudoprimes, Euler pseudoprimes, Factorization by Pollard's Rho method, Simple Continued Fraction, simple infinite continued fractions - traditional Cryptosystem, limitations, Public Key Cryptography Diffie-Hellmann key exchange, Discrete Logarithm problem, One-way functions, Trapdoor functions, RSA cryptosystem, Digital signature schemes, Digital signature standards, RSA signature schemes - Introduction to Elliptic Curves - Elliptic Curve Cryptography

PART.II GENERAL KNOWLEDGE AND CURRENT AFFAIRS

PART.III BASIC FACTS OF INDIA

Geography of India- Physical Features- Climate-Soils- Rivers- Famous Sites – Etc
Demography- Economic and Social Development-Poverty Alleviation-Economy and Planning-Etc

History of India- Period from 1857 to 1947- National Movement- Etc.

NOTE: - It may be noted that apart from the topics detailed above, questions from other topics prescribed for the educational qualification of the post may also appear in the question paper. There is no undertaking that all the topics above may be covered in the question paper.