लोक सेवा आयोग

संघीय संसद सेवा, सूचना प्रविधि समूह, राजपत्राङ्कित तृतीय श्रेणी, कम्प्युटर प्रोग्रामर पदको खुला प्रतियोगितात्मक परीक्षाको पाठ्यक्रम

द्वितीय पत्र (Paper II): Technical Subject

Section A

3 Questions × 10 Marks	30 Marks

1. Digital Design and Computer Architecture

1.1. Digital Design
- 1.1.1. Digital and Analog Systems
- 1.1.2. Number Systems
- 1.1.3. Logic Elements
- 1.1.4. Combinational Logic Circuits
- 1.1.5. Sequential Logic
- 1.1.6. Arithmetic Circuits
- 1.1.7. MSI Logic Circuits
- 1.1.8. Counters and Registers
- 1.1.9. IC logic families
- 1.1.10. Interfacing with Analog Devices
- 1.1.11. Memory Devices

1.2. Computer Architecture
- 1.2.1. Basic Structures : sequential circuits, design procedure, state table and state diagram, Von Neumann / Harvard architecture, RISC/CISC architecture
- 1.2.2. Addressing Methods and Programs, representation of data, arithmetic operations, basic operational concepts, bus structures, instruction cycle and excitation cycle
- 1.2.3. Processing Unit: instruction formats, arithmetic and logical instruction
- 1.2.4. Addressing modes
- 1.2.5. Input Output Organization : I/O programming , memory mapped I/O, basic interrupt system, Direct Memory Access (DMA)
- 1.2.6. Arithmetic Operations
- 1.2.7. Memory Systems

2. Operating System

2.1. Processes and Threads: Symmetric Multiprocessing, Micro-kernels, Concurrency, Mutual Exclusion and Synchronization, Deadlock

2.2. Scheduling

2.3. Memory Management

2.4. Input Output and Files: I/O devices and its organization, Principles of I/O software and hardware, Disks, Files and directories organization, File System Implementation

2.5. Distributed Systems: Distributed Message passing, RPC, Client/Server Computing, Clusters

2.6. Security : Authentication and Access Authorization, System Flaws and Attacks, Trusted system

3. Computer Networks

3.1. Protocol stack, OSI and TCP/IP models

3.2. Link Layer: services, error detection and correction, multiple access protocols, LAN addressing and ARP (Address Resolution Protocol), Ethernet, CSMA/CD multiple access protocol, Hubs, Bridges, and Switches, Wireless LANs, PPP (Point to Point Protocol), Wide area protocols

3.3. Network Layer :services, datagram and virtual circuits, routing principles and algorithms, Internet Protocol (IP), IP addressing, IP transport, fragmentation

and assembly, ICMP (Internet Control Message Protocol), routing on the internet, RIP (Routing Information Protocol), OSPF (Open Shortest Path First), router internals, IPv6

3.4. Transport Layer: principles, multiplexing and demultiplexing, UDP, TCP, flow control, principles of congestion control, TCP congestion control

3.5. Application Layer : Web and Web caching, FTP (File Transfer Protocol), Electronic mail, DNS (Domain Name Service), socket programming

Section B

3 Questions × 10 Marks	30 Marks

4. Structured and Object Oriented Programming

4.1. Concept of Procedural Programming, Structural Programming, Object-Oriented Programming

4.2. Data types, Abstract Data Types (ADT)

4.3. Operators, variables and assignments

4.4. Control structures

4.5. Procedure/function

4.6. Class definitions, encapsulation, inheritance, object composition, polymorphism

4.7. Concept of C programming, C++ Programming

5. Database Management System

5.1. The relational model, ER model

5.2. Structured Query Language (SQL)

5.3. Functional dependency, normalization and relational database design

5.4. Transaction Management and Concurrency Control: Concurrent execution of the user programs, transactions, Concurrency control techniques

5.5. Crash Recovery : types of failure, Recovery techniques

5.6. Query Processing and Optimization

5.7. Indexing : Hash based indexing, Tree based indexing

5.8. Distributed Database Systems and Object oriented database system

5.9. Data Mining and Data Warehousing

5.10. Database Security

6. Software Engineering

6.1. Software process: The software lifecycle models, risk-driven approaches

6.2. Software project management: Relationship to lifecycle, project planning, project control, project organization, risk management, cost models, configuration management, version control, quality assurance, metrics

6.3. Software requirements: Requirements analysis, requirements solicitation, analysis tools, requirements definition, requirements specification, static and dynamic specifications, requirements review, feasibility analysis

6.4. Software design: Design for reuse and with reuse, design for change, design notations, design evaluation and validation

6.5. Implementation: Programming standards and procedures, modularity, data abstraction, static analysis, unit testing, integration testing, regression testing, tools for testing, fault tolerance

6.6. Maintenance: The maintenance problem, the nature of maintenance, planning for maintenance

6.7. SE issues: Formal methods, tools and environments for software engineering, role of programming paradigm, process maturity and Improvement, ISO standards, SEI-CMM, CASE tools

Section C

2 Questions × 5 Marks	**20 Marks**
1 Question × 10 Marks	

7. Multimedia System

7.1. Introduction: Global structure of Multimedia; Medium; Multimedia System and properties
7.2. Sound / Audio System: Concept of Sound System; Music and Speech; Speech Generation, Speech Analysis, Speech Transmission
7.3. Images and Graphics: Digital Image representation; Image and Graphics Format; Image Synthesis, analysis and transmission
7.4. Video and Animation: Video signal representation, computer video format; computer based animation
7.5. Data Compression: Storage Space; Coding Requirements; Source, Entropy and Hybrid Coding; Lossy Sequential DCT- based Mode; Expanded Lossy DCT-based Mode; JPEG and MPEG

8. Data Structure and Algorithms

8.1. General concepts : Abstract data Type, Time and space analysis of algorithms, Big oh and theta notations, Average, best and worst case analysis
8.2. Linear data structures
8.3. Trees: General and binary trees, Representations and traversals, Binary search trees, balancing trees, AVL trees, 2-3 trees, red-black trees, self-adjusting trees, Splay Trees
8.4. Algorithm design techniques: Greedy methods, Priority queue search, Exhaustive search, Divide and conquer, Dynamic programming, Recursion
8.5. Hashing
8.6. Graphs and digraphs
8.7. Sorting

9. MIS and Web Engineering

9.1. Information Systems and Decision Making; Knowledge Management.
9.2. Strategic use of Information Technology; Work Process Redesign (Reengineering) with Information Technology; Enterprise Resources Planning Systems
9.3. Information Systems Security, Information Privacy, and Global Information Technology issues
9.4. Web Technology: Internet, Intranet, WWW, Static and Dynamic Web Page; Web Clients; Web Servers; Client Server Architecture: Single Tier, Two-Tier, Multi-Tier; HTTP: HTTP Request and Response; URL, Client Side Scripting, Server Side Scripting, Web 2.0
9.5. Hyper Text Markup Language: Introduction to HTML; Elements of HTML Document; HTML Elements and HTML Attributes, Headings, Paragraph, Division, Formatting; Image element; Anchors; Lists; Tables; Frames; Forms
9.6. Client Side Scripting with JavaScript
9.7. Basics of AJAX; Introduction to XML and its application

Section D

2 Questions × 5 Marks	**20 Marks**
1 Question × 10 Marks	

10. Theory of Computation

10.1. DFA and NDFA, regular expressions, regular grammars
10.2. CFGs, Parsing and ambiguity, Pushdown automata, NPDAs & CFGs
10.3. Turing machines
10.4. Recursively enumerable languages Unrestricted grammars
10.5. The Chomsky hierarchy, Undecidable problems, Church's Thesis
10.6. Complexity Theory, P and NP

11. Artificial Intelligence

11.1. Search: Uninformed search techniques- depth first search, breadth first search, depth limit search, and search strategy comparison; Informed search techniques-hill climbing, best first search, greedy search
11.2. Learning: Supervised Learning; Unsupervised Learning; Semi-supervised Learning; Reinforcement Learning; Neural Networks; Support Vector Machine (SVM); Self Organizing Map (SOM); Genetic Algorithms; Clustering; Decision Trees.
11.3. Automated reasoning: FOPL; Knowledge Representation Languages. Basic Concepts of Natural Language Processing (NLP)
11.4. Game Playing

12. Advanced Topics in IT

12.1. Parallel and distributed computing
12.2. High speed networks
12.3. Software Architecture
12.4. Cryptography and network security
12.5. E-commerce
12.6. Software Project Management
12.7. Cloud Computing
12.8. Big Data Analytics
12.9. Internet of Things (IoT)
12.10. Machine Learning

Note: Questions should be asked from all units.

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प्रथम चरणको लिखित परीक्षाबाट छनौट भएका उम्मेदवारहरुलाई मात्र
लिइने **सामूहिक परीक्षण (Group Test)** को लागि

सामूहिक छलफल (Group Discussion)

यस प्रयोजनको लागि गरिने परीक्षण १० पूर्णाङ्क र ३० मिनेट अवधिको हुनेछ जुन नेता विहिन सामूहिक छलफल (Leaderless Group Discussion) को रुपमा अवलम्वन गरिने छ । दिइएको प्रश्न वा Topic का विषयमा पालैपालोसँग निर्दिष्ट समय भित्र समूह वीच छलफल गर्दै प्रत्येक उम्मेदवारले व्यक्तिगत प्रस्तुति (Individual Presentation) गर्नु पर्नेछ । यस परीक्षणमा मूल्याङ्कनको लागि देहाय अनुसारको ३ जनाको समिति रहनेछ ।

आयोगका अध्यक्ष वा सदस्य	-	अध्यक्ष
मनोविज्ञ	-	सदस्य
दक्ष/विज्ञ (१ जना)	-	सदस्य

सामूहिक छलफलमा दिइने नमुना प्रश्न वा Topic

उदाहरणको लागि - उर्जा संकट, गरीबी निवारण, स्वास्थ्य बीमा, खाद्य सुरक्षा, प्रतिभा पलायन जस्ता Topics मध्ये कुनै एक Topic मात्र दिइनेछ ।