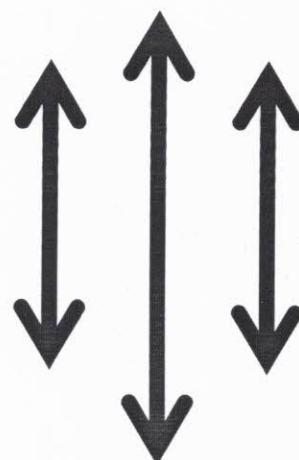
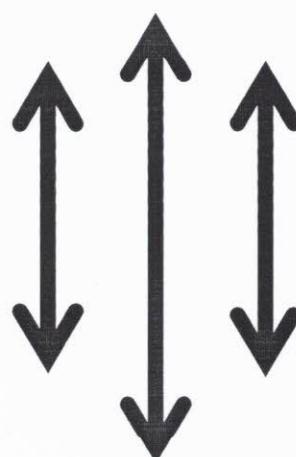


नेपाली सेना  
श्री भर्ना छनौट निर्देशनालय,  
जङ्गी अड्डा



प्रा.उ.से कम्प्युटर ईन्जिनियर (खुला) पदको लिखित  
परीक्षाको पाठ्यक्रम



२०८०

## प्रा.उ.से. कम्प्युटर ईंजिनियर (खुला) पदको लिखित परीक्षाको

### पाठ्यक्रम



पूर्णाङ्क : १५०

उत्तीर्णाङ्क : ६०

यो पाठ्यक्रम नेपाली सेनाको प्रा.उ.से. कम्प्युटर ईंजिनियर (खुला) पदका उम्मेदवार छनौट परीक्षाको लागि निर्धारण गरिएको हो । लिखित परीक्षामा सरिक हुने उम्मेदवारहरूको पेशा सम्बन्धी विषयलाई आधार मानी प्रश्नहरू सोधिने छ ।

- (क) लिखित परीक्षाको माध्यम नेपाली/अंग्रेजी वा दुवै भाषा हुनेछ ।
- (ख) लिखित परीक्षाबाट छनौट भएका उम्मेदवारहरूलाई मात्र अर्को चरणको परीक्षामा सम्मिलित गराईनेछ ।
- (ग) प्रश्नपत्र निर्माण गर्दा पाठ्यक्रममा समावेश भएका सबै विषयलाई यथासम्भव समेटिने छ ।
- (घ) वस्तुगत र विषयगत संयुक्त रूपमा पूर्णाङ्क र उत्तीर्णाङ्क कायम गरिनेछ ।
- (ङ) वस्तुगत र विषयगत परीक्षाको पाठ्यक्रम एउटै हुनेछ ।
- (च) वस्तुगत र विषयगत विषयको लिखित परीक्षा एकैपटक वा छुट्टाछुट्टै गरी लिन सकिनेछ ।
- (छ) यो पाठ्यक्रम मिति २०८०/०८/२१ गतेबाट लागु हुनेछ ।

### लिखित परीक्षाको योजना र पाठ्यक्रम

विषय	पूर्णाङ्क	उत्तीर्णाङ्क	परीक्षा प्रणाली		प्रश्न संख्या अङ्क	समय
पेशा सम्बन्धी	७५	६०	वस्तुगत (Objective)	बहुवैकल्पिक प्रश्न (MCQs) ७५	७५ प्रश्न x १ अङ्क = ७५	१ घण्टा १५ मिनेट
	७५		विषयगत (Subjective)	छोटो उत्तर $९ \times ५ = ४५$ लामो उत्तर $३ \times १० = ३०$	९ प्रश्न x ५ अङ्क = ४५ ३ प्रश्न x १० अङ्क = ३०	३ घण्टा

## विषय: पेशा सम्बन्धी

### (प्रा.उ.से. कम्प्युटर इंजिनियर - खुला)



## **1. Operating Systems**

- 1.1 **OS Fundamentals:** Definition of OS, Functions of OS, Components of OS, Types of Operating System, Application Software vs System Software, LINUX vs. UNIX, Primary, Extended and Logical Partition
- 1.2 **Principle of Concurrency:** Mutual Exclusion, Critical Region, Race Condition, Solution to Race Condition (Disabling Interrupts, Lock Variables, Strict Alteration, Petersons Solution, Lock Based Approach, Priority Inversion, sleep and wakeup), Semaphore and mutex, Monitors , Classical Problems of Synchronization: Readers-Writers Problem, Producer Consumer Problem, Dining Philosopher problem
- 1.3 **Process Management:** Program vs. Process, Process Life Cycle, User Bound and I/O bound process, Process Control Block, Context Switching, Concept of Multiprogramming, Concept of Threads, User level and Kernel level Threads, Process vs. Threads
- 1.4 **Process Scheduling:** Concept of Process Scheduling: FCFS, SPN, SRT, Round Robin, Multi level feedback
- 1.5 **Deadlock:** Definition, Detection, Avoidance, Prevention and Recovery examples, Livelock, Two phase locking, Starvation
- 1.6 **Memory Management:** Memory hierarchy, Storage Placement Policies: First Fit, Best Fit, Worst Fit, Fixed Partitioning and Variable Partitioning memory management, Virtual Memory, Paging, Demand Paging, Memory Protection and Sharing, Limit Register, Swapping, Segmentation, Paging and Segmentation Combined, Concept of Thrashing, Page Replacement Algorithms, Overlays, TLBs
- 1.7 **Input/output:** Block Devices and Character Devices, Concept of Device Driver and Controller, Synchronous vs. Asynchronous Transfer, Disk Scheduling Algorithms, RAID, Hard Drive Reliability, MTBF, File Organization
- 1.8 **Security:** Security breaches, Types of Attacks, Security Policy and Access Control, Basics of Cryptography, Protection Mechanisms, Authentication, OS Design Considerations For Security, Access Control Lists And OS Support

## **2. Computer Organization and Architecture**

- 2.1 **Computer Organization Fundamentals:** Instruction Cycle, Execution Cycle, CPU Bus Structure, Codes, Microoperations (Arithmetic, Logic and Shift), Von Neumann/Harvard Architecture, Gray Code, Error Detection
- 2.2 **CPU:** CPU Design and Accumulator Logic, RISC vs. CISC, One address and two address instruction, Instruction Format, Addressing modes
- 2.3 **Control Unit:** Control Memory: Addressing sequencing, Microinstruction Format, Symbolic Microinstructions, Symbolic Micro program, Control Unit Operation, Design of control unit, Hardwired control, Microprogrammed Control
- 2.4 **Pipeline and Vector processing:** Pipelining, Parallel processing, Arithmetic Pipeline, Instruction Pipeline, RISC pipeline, Vector processing, Array processing
- 2.5 **Computer Arithmetic:** Addition algorithm, Subtraction algorithm, Multiplication algorithm, Division algorithms, Logical operation
- 2.6 **Memory:** Cache memory principles, Elements of Cache design, Cache size, Mapping function, Replacement algorithm, Write policy, Number of caches
- 2.7 **Input-Output organization:** Peripheral devices, Input-output interface, Modes of transfer (Programmed I/O, Interrupt-driven I/O, Direct Memory access, I/O processor, Data Communication processor)

## **3. Computer Networks**

- 3.1 OSI model vs TCP/IP model; Half and Full Duplex Ethernet, Straight-Through, Crossover and Rolled Cabling, Wireless Networking (802.11 a,b,c,d,e,g), Spanning Tree Protocol , ARP, RARP
- 3.2 **Data Link Layer:** Collision Domain, Broadcast Domain, CSMA/CD Protocol, persistent

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and non-persistent CSMA, Sliding Window Protocol, Hamming Distance and Hamming Codes, Computing Checksum, CRC Code, Unipolar, Polar and bipolar line encoding types, Flow and Error Control Mechanisms (Stop-and-Wait ARQ, Go-Back-N ARQ, Selective Repeat ARQ), Token Ring, FDDI Operation, Shannon Theory, Nyquist Bit Rate, SNR, PCM

**3.3 Virtual LANS(VLAN):** VLAN Basics, Static and Dynamic VLANS, Identifying VLANS, VLAN Trunking Protocol(VTP), Configuring VLANS

**3.4 TCP and IP:** Three Way TCP Handshakes; Hierarchical IP addressing Scheme, Public and Private IP address, IP Address Classes, CIDR, Introduction to NAT, Broadcast Addresses, IP subnetting and variable length subnet masks, Integrating IPV4 and IPV6 networking Environments

**3.5 Routing:** Routing Basics, IP Routing Process, Distance-Vector Routing Protocols and Link State Routing Protocols, Routing Information Protocol(RIP), Interior gateway Routing Protocol (IGRP), Enhanced IGRP, Open Shortest Path First Routing, BGP Protocol, Dijkstras and Bellman Ford Routing Algorithm Exercises

**3.6 Transport Layer:** UDP, TCP, Principles of Congestion Control, Token Bucket and Leaky Bucket, multiplexing and demultiplexing, Circuit Switching vs Packet Switching

**3.7 Application Layer:** DHCP and DNS Operations, Cookies Operation, Web Caching, FTP, E-mail, POP3, IMAP Socket Programming, IPSec

#### **4. Information and IT/IS Security**

**4.1 Network Infrastructure Security:** LAN, Client/Server, Wireless, Internet Threats and Security; Authentication and Authorization; Infrastructure Operation and Architecture Review; Technical Testing (Router, Switch, Wireless Testing)

**4.2** Endpoint Risks and Threats, Web and Email Controls, Data Loss Prevention, Malware Detection and Quarantine, SPAM, Phishing and E-mail fraud, Patch Management and Enforcement, Data Loss Prevention Testing

**4.3 Secure Remote Access:** VPN, Remote Access Threats and Risks, Testing Authentication, IPsec, SSL, Site-to-Site and Mobile user access control testing

**4.4 Access Control:** Access Control Threats and Risks, Access Control Operational and Architecture Review, Posture Assessment Testing, Types of Access Control, General Controls vs Application Controls, IT Application Controls Audit, IT Audit, Internal Controls and CMMI

#### **5. Data Structure and Algorithms**

**5.1 Stack and Queue:** Stack Operation, Evaluation of Infix, Postfix and Prefix expressions; Operations in queue (Enqueue and Dequeue), Linear and circular queue, Priority queue

**5.2 List and Linked List:** Static and dynamic list, Array implementation of lists, Queues as list, Operations in linked list, Linked stacks and queues, Doubly linked lists and its application, Principle of recursion, TOH and Fibonacci sequence, Applications of recursion

**5.3 Trees:** Operation in Binary tree, Tree search, insertion/deletions, Tree traversals (pre-order, post-order and in-order), Height, level and depth of a tree, AVL balanced trees and Balancing algorithm, The Huffman algorithm, B-Tree, Red Black Tree

**5.4 Sorting:** Types of sorting: internal and external, Insertion and selection sort, Exchange sort, Merge and Redix sort, Shell sort, Heap sort as a priority queue, Big 'O' notation and Efficiency of sorting

**5.5 Searching:** Sequential, Binary and Tree search, General search tree, Hashing, Hash function and hash table, Collision resolution technique, Asymptotic notations: , O,, o, notations and their properties

5.6 **Graphs:** Transitive closure, Warshall's algorithm, Graphs type, Graph traversal and Spanning forest, Depth First Traversal and Breadth First Traversal, Topological sorting: Depth first, Breadth first topological sorting, Minimum spanning trees, Prim's, Kruskal's and Round-Robin algorithms, Shortest-path algorithm, Greedy algorithm, Dijkstra's Algorithm

## 6. Database Management Systems

- 6.1 **DBMS Fundamentals:** Data Vs Information, RDBMS vs. OODBMS, Data Models, Data Abstraction and Data Independence, 3-level Architecture (ANSI/APARC Architecture), DBA, Distributed Database, Object oriented, deductive, spatial, temporal and constraint database management systems, Concepts of DDL, DML and DCL
- 6.2 Entity Relationship Model and Enhanced Entity Relationship development with Case Studies, ER-to-Relational Mapping
- 6.3 **SQL Queries:** Join (Left and Right Join), Subquery, View, Function and Stored Procedure Examples, Primary Key Constraints, Referential Integrity Constraints (on cascade update, on cascade delete)
- 6.4 Normalization (1NF, 2NF, 3NF, BCNF, 4NF, 5NF) Examples, Functional Dependency, Multi-valued and Join Dependency, Trivial and non-trivial FDs, closure of a set of FDs, attribute closure FDs, irreducible set of FDs, Transitivity, Reflexivity and Augmentation properties of FDs
- 6.5 Transaction and Concurrency Control: Transaction ACID Properties, Concurrent Executions
- 6.7 **Indexing:** Hash based indexing and tree based indexing
- 6.8 Data Mining and Data Warehousing
- 6.9 Database Security, Performance Tuning, Concept of Big Data

## 7. Software Engineering

- 7.1 **SDLC Phases:** Prototyping, Incremental vs. Iterative model, RUP/USDP Phases; Spiral Model, Software Types: Program vs Software; TPS, MIS, DSS, EIS, ERP, CRM, SRM; Map Reduce and Hadoop Systems
- 7.2 **Software Analysis:** Requirement analysis techniques and tools; Requirement Engineering and SRS; Functional and Non-Functional Requirement; Feasibility Study and its types; Decision Table and Decision Tree
- 7.3 **Software Estimation:** Basic COCOMO, Intermediate COCOMO, Complete COCOMO, Halstead's Complexity Metrics
- 7.4 **Software Design:** Logical vs Physical Design; UML Diagrams: Use Case Diagram, Class Diagram, Communication Diagram, State Chart Diagram, Sequence Diagram; Activity Diagram; Structure Chart, Qualified Association in Class Diagram DFD ( Level-0,1,2); Software Coupling and Cohesion and its Types; User Interface Design: Wireframe Diagrams
- 7.5 **Software Testing:** Black Box, White Box, Gray Box, Unit, Integration Testing, Regression Testing. Software Fault Tolerance
- 7.6 Software maintenance types, Reverse Engineering; Refactoring and Restructuring
- 7.7 Software Quality: Software Quality Assurance process ;Verification vs Validation; Software Inspection; Clean Room Software Engineering, Software Reviews and FTR; Statistical software quality assurance; Software reliability; ISO Standards
- 7.8 **Software Issues:** Social, Legal and Ethical Issues; Business Process Engineering and Re-Engineering; Concept of Big Data



## **8. Cloud Computing and Virtualization Technologies**

- 8.1 Grid Computing, Clustering, Cloud Computing and its Benefits, Business Driver of Cloud Computing, Cloud Characteristics, RESTful Services
- 8.2 **Cloud Service Models:** Infrastructure as a Service, Platform as a Service, Software as a Service
- 8.3 **Cloud Deployment Models:** Public, Private and Hybrid Clouds
- 8.4 **Cloud Security Threats:** Traffic Eavesdropping, Malicious Intermediary, Denial of Service, Virtualization Attack, Insufficient Authorization, Virtualization Attacks, Flawed Implementation

## **9. Digital Logic**

- 9.1 **Fundamentals:** Coding Types(ASCII Code, BCD, Excess-3 Code, Gray Code), NOT, OR, XOR, AND, NOT, NAND, AND-OR-INVERT Gate, Positive and Negative Logic, SOP and POS methods, Truth Table to Karnaugh Map, Karnaugh Simplifications, Don't care Conditions
- 9.2 **Digital Circuits:** Multiplexers, Demultiplexers, Decoder, BCD-to-Decimal Decoders, Seven-Segment Decoders, Encoders, Parity Generators and Checkers, Magnitude Comparators, Sequential vs. Combinational Circuits, Half Adder, Full Adder, Half Subtractor, Full Subtractor
- 9.3 **Flip Flops and Registers :** RS Flip Flops, Gated Flip Flops, Edge-Triggered RS Flip-Flops, Edge-Triggered D Flip-Flops, Edge Triggered JK Flip Flops, JK Master Slave Flip Flops, Registers( SISO, SIPO, SISO, PISO, PIPO), Shift Registers
- 9.4 **Counter:** Synchronous vs. Asynchronous Counter, Decade counter, Modulo-n Counter, Counter Design
- 9.5 **Sequential Machine Design:** State Diagrams, Transition Tables, Use of flip-flops in realizing the models, Flow tables, excitation maps.

## **10. Fundamentals of Electrical and Electronic Systems**

- 10.1 **Electrical Fundamental:** Basic Circuit Theory, Mesh Analysis and Nodal Analysis, R-L-C Circuit, Bode Diagram, Magnitude and Phase Response, two-port networks
- 10.2 **Electronics Fundamentals:** Kirchhoff's law, Superposition theorem; Thevenin's theorem; Norton's theorem, Zener diode, rectifier-half wave, full wave (center tapped, bridge)

## **11. Data Communication**

- 11.1 **Communication Fundamentals:** Analog and Digital Data Communication System; Transmission Impairments (Attenuation, Noise, Distortion); Periodic and Non-periodic Signals, Deterministic and Random Signals, Energy and Power Signals, Continuous Time and Discrete Time Signals; Unit Impulse Function and Unit Step Function; Data Rate Limits: Nyquist Bit Rate for Noiseless Channel, Shannon Capacity for Noisy Channel; Performance of Channel: Bandwidth, Throughput, Latency, Jitter, Bit Error Rate (BER)

## **12. Theory of Computation**

- 12.1 BNF, Languages, Grammars
- 12.2 DFA, NDFA, regular expressions, regular grammars
- 12.3 Closure, Pigeonhole principle
- 12.4 CFGs, Pushdown Automata
- 12.5 Turing Machines
- 12.6 The Chomsky hierarchy, Undecidable problems
- 12.7 Complexity Theory, P and NP

B  
JW

### **13. Fundamentals of Object Oriented Frameworks**

13.1 **Object Technologies Fundamentals:** Dependency Injection Types: Constructor based; Setter Method Based; Lookup Method Based; Identifying application objects and their dependencies

### **14. GIS**

- 14.1 Introduction to GIS
- 14.2 Data models
- 14.3 Data sources and metadata
- 14.4 Geographic data
- 14.5 Vector analysis techniques
- 14.6 Raster analysis
- 14.7 Geographical statistics and optimization techniques

### **15. Reasoning**

- 15.1 Analytical and logical reasoning
- 15.2 Quantitative Test

(This section covers the examinee's reasoning aptitude as well as the presence of mind. Reasoning is to be done by reading a passage and answering the multiple choices Question whereas quantitative test is carried out by solving the mathematical problem (Which needs no advanced level mathematical background?)



यस पेशा सम्बन्धी विषयको पाठ्यक्रमका एकाइहरूबाट सोधिने प्रश्नहरुको संख्या निम्नानुसार हुन्छ।



Unit No एकाइ नं	MCQs बहुवैकल्पिक प्रश्नको संख्या	Subjective		Weightage अङ्कभार
		छोटो उत्तर प्रश्नको संख्या	लामो उत्तर प्रश्नको संख्या	
1. Operating Systems	5	5		10
2. Computer Organization and Architecture	5		10	15
3. Computer Networks	10		10	20
4. Information Security	5	5		10
5. Data Structure and Algorithms	5		10	15
6. Database management systems	8	10		18
7. Software engineering	5	5		10
8. Cloud computing	5			5
9. Digital logic	5	5		10
10. Fundamental of electric and electronic systems	4			4
11. Data communication	5			5
12. Theory of Computation	4	5		9
13. Fundamentals of object oriented frameworks	5			5
14. GIS	4	5		9
15. Reasoning		5		5
<b>Total</b>	<b>75</b>	<b>45</b>	<b>30</b>	<b>150</b>


  
**प्रा.उ.से कम्प्युटर ईंजिनियर (खुला) संस्कृति पेशा सम्बन्धी विषयको प्रयोगात्मक  
परीक्षाको पाठ्यक्रम**

समय: १ घण्टा ३० मिनेट

पुर्णाङ्क: ५०

उत्तीर्णाङ्क: २५

S.N	Topics	Marks	Time	Remarks
1	Software: Website Design, Database Design, Programming Concepts.	25	1 Hr	
2	Network: Network, Server (DNS, DHCP) Configuration, Virtualization and N/W Troubleshooting.	10		
3	Hardware: Hardware identification and Trouble shooting, assembling etc.	10	30 Mins	
4	Network and Hardware related Viva	5		
<b>Total</b>		<b>50 Marks</b>	<b>1 Hr 30 Mins</b>	



**समाप्त**