

**Nepal Telecom**  
**Nepal Doorsanchar Company Ltd.**  
**Syllabus**

**Paper Second** : (Specialized subject for Computer Engineer Level 7 Open competition)

Time: 2 hours

Full Marks: 100

Pass Marks: 40

All the Questions are Compulsory

| Types of question   | Number of questions | Marks | Total Marks | Remarks  |
|---------------------|---------------------|-------|-------------|--|
| Objective Questions | 30                  | 1     | 30          | 1/4 marks will be deducted for each incorrect answer |
| Short Questions     | 10                  | 4     | 40          |  |
| Long Questions      | 3                   | 10    | 30          |  |
|                     |                     |       | 100         |  |

Use of non-programmable calculator is permitted in the examination hall.

**1. Electronics (Weightage 3%-7%)**

- Diodes, rectifiers, and wave shaping networks.
- FET and bipolar transistors: small-signal and AC analysis.
- Single-stage amplifier design.
- Operational amplifiers and applications.
- Large-signal analysis, wave shaping and bistable circuits: multivibrators, triggers, and waveform generators.
- Digital electronics, including logic gates and integrated circuits.
- Hybrid analog/digital devices, including A/D and D/A converters.

**2. Digital Signal Processing (Weightage 3%-7%)**

- Theory of discrete-time linear systems.
- Digital filtering.
- Discrete Fourier analysis.
- Application to voice and image processing, communications, etc.
- Hardware for digital signal processing, including digital signal processors.

**3. Digital Systems Design (Weightage 3%-7%)**

- Boolean algebra.
- Design of combinatorial and sequential logic.
- Implementation using simple gates.
- Programmable logic devices and gate arrays.
- Characteristics of digital integrated circuit families.
- Analysis and design for controllers, processors, and memories.

- Microprocessors, including components, data flow, signals, and timing.
- Small system design, interconnection of associated devices.
- Computer interfacing, including parallel and serial I/O, interrupts and DMA.
- Common bus structures.

#### **4. Computer Architecture (Weightage 3%-7%)**

- Architecture, programming and I/O.
- Computer structure and typical processor architecture.
- CPU and memory organization, buses.
- Characteristics of I/O and storage devices.
- Processing unit and controller design, hardwired and micro program control.
- Instruction sets and addressing modes; assembly language programming, I/O and interrupt servicing.

#### **5. Advanced Computer Architecture (Weightage 3%-7%)**

- Architecture of high speed workstation and personal processors and systems.
- Instruction set design for pipelined machines.
- Multiple processor architectures, highly parallel machines, systolic arrays,
- Neural networks, multitasking machines, real-time systems, interconnection of multiple processor systems.
- Architectures for specialized purposes, array processors, vector processors.
- Virtual machines.

#### **6. Principles of VLSI (Weightage 3%-7%)**

- Very large scale integrated circuits.
- Simplified design rules.
- Static and dynamic logic, multiphase clocking.
- Memory elements and memory structures.
- Gate arrays and standard cell technology; placement and routing.
- Programmable logic devices.
- I/O devices.

#### **7. Computer Communications (Weightage 10%-20%)**

- Data communications, including signals, modulation and reception.
- Error detecting and correcting codes.
- Circuit and Packet switching.
- Multiplexing, including time, frequency and code division multiplexing.
- Digital networks: ISDN, frame relay and ATM.
- Protocols: the ISO/OSI reference model, X.25.
- Internetworking and router-based networks: the TCP/IP suite of protocols, routing and flow control,
- Internet addressing and domain names.

- Local area networks, topologies, access schemes, medium access and logic layers; CSMA/CD and token ring protocols; segmented and hubbed LANs.

## **8. Artificial Intelligence and Expert Systems (Weightage 3%-7%)**

- Concepts of artificial intelligence.
- Overview of knowledge-based and expert systems.
- Logic programming.
- Programming languages (LISP and Prolog) for AI
- Knowledge representation.
- Rule-based and object-based systems.

## **9. Distributed Systems (Weightage 3%-7%)**

- Characteristics of distributed systems.
- Networked vs. centralized systems.
- Fundamental concepts and mechanisms.
- Client-server systems.
- Process synchronization and inter process communications.
- Principles of fault tolerance.
- Transaction processing techniques.
- Distributed file systems.
- Operating systems for distributed architectures.

## **10. Program Design and Data Structures (Weightage 3%-7%)**

- Programming language syntax and semantics.
- Design of structured and modular programs in a high level language (C, C++.
- Basics of object-oriented programming: classes.
- Non-numerical processing.
- Design and construction of programs involving structured data: arrays, stacks, queues, lists, trees, and records.

## **11. Operating Systems (Weightage 5%-15%)**

- Operating system principles, components, and usage.
- Design and implementation of operating systems.
- Synchronization of concurrent processes, resource allocation, scheduling, protection, and privacy. Data, task, and job management: loading, linking; I/O control.
- Multitasking and multiprocessing.
- Real-time aspects.
- Basic characteristics of modern operating systems: unix, Windows.

## **12. Software Engineering (Weightage 5%-15%)**

- Software cycles and requirements analysis.
- Design, implementation, test, verification and validation, documentation, quality assurance,

- control and life-cycle management of correct, reliable, maintainable, and cost effective software.
- Object Oriented design
- Graphical design tools, design in high-level languages, and data flow driven designs.
- Planning and management of software projects.
- Software maintenance and configuration management
- Source code management

### **13. Data Bases and File Systems (Weightage 3%-7%)**

- Data models, data normalization, data description languages, query facilities, data integrity and reliability, concurrency.
- Data bases: hierarchical, network and relational databases; data organization.
- Relational query languages: relational algebra and calculus, SQL.
- Relational database design.
- Transaction processing, query processing, reports.
- Security and integrity; concurrency control.
- File organization: sequential, indexed and direct access, multiple key, and hashing.
- File processing: records, files, compaction.
- Sorting, merging and updating files.
- Algorithms for inverted lists, multilist, indexed sequential and hierarchical structures.
- File I/O: control, utility, space allocation, and cataloguing.
- Index organization.

### **14. Internet Programming (Weightage 3%-7%)**

- Common Gateway Interface (CGI) application
- Input to CGI: environment variables, accessing from input
- Output from CGI: CGI and response headers
- Forms and CGI: Sending data to the server using HTML tags
- Executing external program and CGI program
- Hypermedia documents: Creating dynamic pages using CGI, PHP
- Introduction to JAVA: JAVA evolution, JAVA history, JAVA features, Difference between JAVA and C/C++, Simple JAVA program, JAVA program structure, JAVA Statements, JAVA virtual machine – Introduction and implementation basics.

### **15. Client Server Computing (Weightage 3%-7%)**

- Client server computing concepts: Building blocks, the state of client server infrastructure
- SQL database services: fundamentals of database servers, functions, procedures, triggers and rules
- SQL middleware basics: SQL API, Open SQL Gateway
- Concept of Data Warehouses
- Client server transaction processing: transaction concepts, transaction models, transaction processing monitors, transaction management standards.

## 16. Cryptography and Network Security (Weightage 3%-7%)

- Introduction to Cryptography: Security attacks, conventional encryption model, simplified DES, Block Cipher principle.
- Principles of Public-Key Cryptosystems: RSA algorithm, Diffie-Hellman Key exchange, Number Theory-Prime and Relatively Prime Numbers
- Message Authentication and Hash function
- Digital Signature and authentication protocols: Digital signatures, Digital signature standards, authentication protocols
- Network Security: Authentication applications – Kerberos, electronic mail security
- Web security: Web security requirements, secure sockets layer and transport layer security, secure electronic transaction.
- Intruders and Viruses related threats
- Firewall design principles
- Introduction to Trusted systems

### द्रष्टव्य :

१. प्रश्नहरू अंग्रेजी तथा नेपाली दूवै वा कूनै एक भाषामा मात्र पनि सोध्न सकिनेछ ।
२. प्रश्नहरू सैद्धान्तिक, व्यावहारिक र विश्लेषणात्मक किसिमबाट सोधिनेछन् ।
३. परीक्षार्थीहरूले अंग्रेजी वा नेपाली मध्ये कूनै एक वा दूवै भाषामा उत्तर दिन सक्नेछन् ।
४. प्रश्नहरूसंग सम्बन्धित ऐन, नीति, नियम तथा प्रचलित नेपाल कानूनहरू (नेपाल दुरसञ्चार कम्पनी लिमिटेडसंग सम्बन्धित समेत) मा परीक्षा मिति भन्दा तीन महिना अघिसम्ममा संशोधन भई कायम रहेका व्यवस्था लागु हुनेछ ।
५. यथासम्भव सबै शिर्षकहरूलाई समेट्ने गरी प्रश्नहरू सोधिनेछन् ।