

नेपाल राष्ट्र बैंक
प्राविधिक सेवा, सूचना प्रविधि समूह, अधिकृत तृतीय श्रेणी, सहायक निर्देशक (सूचना प्रविधि)
पदको खुला प्रतियोगितात्मक परीक्षाको पाठ्यक्रम

पाठ्यक्रम योजनालाई निम्नानुसारका तीन चरणमा विभाजन गरिएको छ :

प्रथम चरण: लिखित परीक्षा

पूर्णाङ्क : ३००

द्वितीय चरण : प्रयोगात्मक परीक्षा

पूर्णाङ्क : ५०

तृतीय चरण : अन्तर्वार्ता

पूर्णाङ्क : ४०

परीक्षा योजना (Examination Scheme)

1 First Stage: Written Examination

Paper	Subject	Full marks	Pass marks	Exam System		No. of Questions X Marks	Time
Paper I	Information Technology – I	100	40	Objective	MCQs*	25 X 1 = 25	30 minutes
				Subjective	Short Answer	9 X 5 = 45	2 hours 30 minutes
					Long Answer	3 X 10 = 30	
Paper II	Information Technology - II	100	40	Objective	MCQs*	25 X 1 = 25	30 minutes
				Subjective	Short Answer	9 X 5 = 45	2 hours 30 minutes
					Long Answer	3 X 10 = 30	
Paper III	Current Developments in IT Sector and Emerging Technologies	100	40	Objective	MCQs*	25 X 1 = 25	30 minutes
				Subjective	Short Answer	9 X 5 = 45	2 hours 30 minutes
					Long Answer	3 X 10 = 30	

MCQs: Multiple Choice Questions

*0.2 marks will be deducted for each incorrect answer

2 Second Stage: Practical Exam (Full Marks: 50 Pass Marks: 25)

3 Third Stage: Interview (Full Marks: 40)

Remarks:

- Candidates are required to answer all questions.
- This curriculum is designed for the open and inclusive examination of Office Third, Assistant Director (IT).
- Questions will be asked in English.
- Examinee should use English language to answer.
- Candidates should write their answers of MCQs, short questions and long questions on separate answer sheets. Calculator is not allowed for the MCQs.
- In written examination and practical examination, questions will be asked in English.
- The candidates selected from the first stage will be called for the second and third stages.
- Date of approval : 2080/05/07**

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Paper I
Information Technology – I
Section (A)

1. Computer Architecture & Organization and Microprocessors

- 1.1. Basic Structures: Sequential Circuits, Design Procedure, State Diagram, and State Table, Von Neumann / Harvard Architecture, RISC/CISC Architecture, SISD, SIMD, MISD, MIMD, Addressing Methods and Programs, Representation of Data, Arithmetic Operations, Basic Operational Concepts, Bus Structures, Instruction, Cycle and Excitation Cycle
- 1.2. Processing Unit: Instruction Formats, Arithmetic and Logical Instruction, Addressing Modes and Formats
- 1.3. Input Output Organization: I/O programming, Memory Mapped I/O, Basic Interrupt System, DMA
- 1.4. Computer Arithmetic: Arithmetic and Logic Unit, Integer Arithmetic and Representation, Floating-Point Arithmetic
- 1.5. Memory Systems: Internal Memory, Cache Memory, Direct Memory Access, External Memory
- 1.6. CPU Structure and Function: Processor and Register Organization, Power PC Processor
- 1.7. 808X and Intel Microprocessors: Programming and Interfacing, Microinstruction Sequencing and Execution

2. Digital Logic Design

- 2.1. Introduction
- 2.2. Digital Logic: Basic, Exclusive and Universal Gates, Positive and Negative Logics
- 2.3. Combinational Logic Circuits: Boolean Algebra, K-Map, Minterms and Maxterms, SOP and POS
- 2.4. Data Processing Circuits: Adders and Subtractors, Multiplexer and Demultiplexer, Encoders and Decoders, Parity Generators and Checkers, Comparators, ROM and PLDs
- 2.5. Arithmetic Circuits: Binary Addition, Subtraction, Signed- and Unsigned Numbers
- 2.6. Flip-flops: Latches and Flip-flops, SR, D, T and JK Flip-flops, Flip-flop Conversion, Characteristic Equations, Excitation Tables, Master-slave Flip-flops
- 2.7. Registers: Different Types of Flip-flops, SISO, SIPO, PISO, PIPO
- 2.8. Counters: Synchronous Counters, Asynchronous Counters, Up/Down Counters, Modulus Counters, Decade Counters, Digital Clock
- 2.9. Sequential Machines: Synchronous Machines with Single and Multiple Serial Inputs, Synchronous Machines Design using Different types of Flip-flops, Asynchronous Machine Design Examples
- 2.10. Digital Integrated Circuits: BJT and MOSFET as the Switches, RTL and DTL Circuits, TTL Circuits, Integrated Injection Logics (I²L), Emitter-Coupled Logic (ECL), MOS and CMOS Logics, Bi-MOS Logic Circuits

3. Operating Systems

- 3.1. Definition, Development and Functions of Operating System (OS), Functional Architecture of OS, Types of OS, Network and distributed OS

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- 3.2. Processes and Threads: Symmetric Multiprocessing, Micro-kernels, Concurrency, Mutual Exclusion and Synchronization, Inter Process Communications, Semaphores. Features of Process Scheduling; List the features of Inter-Process Communication and Deadlock scheduling
- 3.3. Disk Allocation and Scheduling Methods, Basic Memory Management strategies, Virtual Memory Management Techniques, Define a Process and features of the Process Management System
- 3.4. Concepts of Parallel and Distributed Processing, Identify Security Threats to Operating Systems, authentication and access authorization, system flaws and attacks, trusted system
- 3.5. 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, Interrupt handling
- 3.6. Distributed Systems: Distributed Message passing, RPC, Client/Server Computing, Cluster computing

4. Database Management System and Design

- 4.1. Introduction, A Database Model, Relational Database Model, Integrity, RDBMS
- 4.2. SQL and Embedded SQL
- 4.3. Writing Basic SQL queries (DDL, DML, DCL)
- 4.4. SQL middleware basics: SQL API, Open SQL Gateway
- 4.5. Restricting and Sorting Data
- 4.6. Sub Queries, Manipulating Data and Creating & Managing Tables
- 4.7. Creating Views and Controlling User Access
- 4.8. Using Set Operators, Date time Function
- 4.9. Relational Database Design, ER Diagram, Keys (primary, foreign, candidate, alternate keys)
- 4.10. Normalizations (1NF, 2NF, 3NF, BCNF, 4NF) and functional dependencies
- 4.11. Basic Concept of major RDBMS products (MSSQL, Oracle, MariaDB etc.)
- 4.12. Concept of Time series DB
- 4.13. Fundamentals of database servers, functions, procedures, triggers and rules
- 4.14. Transaction Management and Concurrency Control: Concurrent execution of the user
- 4.15. programs, transactions, Concurrency control techniques
- 4.16. Crash Recovery: Types of failure, Recovery techniques
- 4.17. Query Processing and Optimization
- 4.18. Indexing: Hash based indexing, Tree based indexing
- 4.19. Distributed Database Systems and Object-oriented database system
- 4.20. Data Mining and Data Warehousing
- 4.21. Security Management System

Section (B)

1. Computer Networks

- 1.1. Definition, OSI & TCP/IP reference model, Topologies, Client/Server Model & Peer2Peer Model
- 1.2. Network Components: Repeater, Hub, Bridge, Switch, and Router
- 1.3. Link Layer: Services, Flow and Error Control, error detection and correction, multiple access protocols (ALOHA, Slotted ALOHA), 802.3 Ethernet CSMA/CD, Token Bus,

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Token Ring, FDDI, Protocols: PPP, HDLC, Virtual circuit switching: Frame relay, ATM, X.25, MPLS

- 1.4. Network Layer: services, datagram and virtual circuits, routing principles and algorithms, Internet Protocols (IPv4/v6) header format, IPv4/v6 addressing and subnetting, VLSM, CIDR, ICMPv4/v6 error/information messages, Routing: interior/exterior routing, unicast/multicast routing, adaptive/non-adaptive routing. Routing protocols: RIP, OSPF, BGP, IS-IS
 - 1.5. Transport Layer: Services, multiplexing and De-multiplexing, UDP, TCP, flow control, TCP sliding window, principles of congestion control, TCP congestion control, Open/close loop congestion control, Leaky bucket & Token Bucket algorithm, overview of socket programming, TCP/UDP Sockets
 - 1.6. Upper layers: Application, presentation and session layer functionalizes, principles of WWW, DNS, DHCP, FTP, email protocols: SMTP/PoP/IMAP, PGP
 - 1.7. Network management: Server concepts-Proxy/web/DNS servers, IP interconnection, Tier ISP architecture, VoIP, FoIP, remote login (telnet, ssh), Traffic monitoring (MRTG, bandwidth, throughput, latency/delay)
 - 1.8. Advanced Data Storage Techniques: Network Attached Storage, Storage Area Networks
 - 1.9. Introduction to Latest networking: Software-Defined Networking, Software-Defined IPv6 (SoDIP6) Network, IPv6 network migration methods, SDN migration methods, IoT, WSN, NGN
- 2. Distributed System**
- 2.1. Client server computing concepts: Building blocks, the state of distributed client server infrastructure
 - 2.2. Fundamental models of Distributed system, distributed object based communications: RPC/RMI, CORBA
 - 2.3. Synchronization in Distributed System (DS), physical/logical clocks (Cristian, Lamport, Vector clocks), Distributed Mutual Exclusion, Election in DS
 - 2.4. Replication and Fault Tolerant, Recovery approach in DS, Distributed file system (SUN-NFS, HDFS)
 - 2.5. Distributed transaction and concurrency control methods, Distributed deadlock
- 3. Cryptography and Network Security**
- 3.1. Introduction to Cryptography: Security attacks, conventional encryption model, simplified DES
 - 3.2. Block Cypher principle
 - 3.3. Principles of Public-Key Cryptosystems: RSA algorithm, Diffie-Hellman Key exchange, Number Theory-Prime and Relatively Prime Numbers
 - 3.4. Message Authentication and Hash function
 - 3.5. Digital Signature and authentication protocols: Digital signatures, Digital signature standards, authentication protocols
 - 3.6. Network Security: Authentication applications – Kerberos, electronic mail security
 - 3.7. Web security: Web security requirements, secure sockets layer and transport layer security, secure electronic transaction
 - 3.8. Intruders and Viruses related threats
 - 3.9. Firewall design principles, DMZ, masquerading, proxy firewall, NATing

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- 3.10. Information security and Audit, introduction to Certified Information Systems Auditor (CISA), Service Organization Control (SOC) 2 certification
- 3.11. Introduction to Blockchain technology, security in cloud/fog/edge computing

Section	Chapter/ Unit	Multiple Choice Questions (MCQ)	Short Questions	Long Questions
Section A	1	4	1	1
	2	3	1	
	3	3	1	1
	4	3	1	
Section B	1	2	2	1
	2	5	1	
	3	5	2 *(One question from Unit 3.1-3.5 and one question from Unit 3.6-3.10)	
	No. of questions	25	9	3
	Marks	25×1=25	9×5=45	3×10=30
		Total 100		

Paper II
Information Technology – II
Section (A)

1. Programming Language

- 1.1. Overview of Programming Language: History, Programming Paradigms, The role of Language translates in the Programming Process
- 1.2. Fundamental Issues in Language Design
- 1.3. Virtual Machines, Code Generation, Loop Optimization
- 1.4. Concept of Procedural Programming, Structural Programming, Object-Oriented Programming
- 1.5. Fundamentals of C/C++ programming
- 1.6. Java Programming for Declaration, Modularity and Storage Management Software Development

2. Data Structure and Algorithms

- 2.1. Fundamental of Data Structures, Abstract Data types
- 2.2. Stacks, Queues, Lists, Linked Lists
- 2.3. Trees: Traversal, Implementations, Binary Trees, Binary Search Trees, Balanced Search Trees, AVL Trees
- 2.4. Indexing Methods. Hashing Trees, Suffix Trees
- 2.5. Time and space complexity, Bog O' Notation
- 2.6. Analysis of Simple Recursive and Non-recursive Algorithms
- 2.7. Searching, Merging and Sorting, Divide-and-Conquer, Dynamic Programming, Greedy Methods, Backtracking
- 2.8. Graph algorithms: Depth-First Search and Breadth-first Search, Shortest Path Problems, Minimum Spanning Trees, Directed Acyclic Graphs

3. Discrete Mathematics

- 3.1. Propositional Logic
- 3.2. Predicate Logic and Quantification
- 3.3. Methods of Proof
- 3.4. Sets and Functions
- 3.5. Arithmetic Algorithms
- 3.6. Growth of Functions
- 3.7. Computational Complexity of Algorithms
- 3.8. Integer properties and Matrices
- 3.9. Mathematical Induction
- 3.10. Recursion
- 3.11. Sequences and Summations
- 3.12. Program Correctness

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- 3.13. Graphs and its Applications
- 3.14. Trees and its Applications
- 3.15. Languages and Grammars
- 3.16. Finite-State Machines
- 3.17. Automata and Language Recognition
- 3.18. Turing Machines

4. Compiler Design

- 4.1. The Structure of a Compiler
- 4.2. Lexical Analysis, Syntax analysis, semantic analysis
- 4.3. Top down Parsing/ Bottom up Parsing
- 4.4. Syntax Directed Translation
- 4.5. Types and Type Checking
- 4.6. Run-Time Storage Administration
- 4.7. Intermediate Code generation, code generator, code optimization
- 4.8. Architecture and recent development on compilers

Section (B)

1. System Analysis and Design

- 1.1. Definition of the System, System Owner, System User, System Designers and system Builders, System Analysts, Variations on the System Analyst title, System development life Cycle
- 1.2. Prototyping: Spiral, Waterfall, Rapid Application Development (RAD), Joint Application Development (JAD)
- 1.3. System Design Environment: Concept formulations
- 1.4. Requirements analysis: Representing System Analysis Model, Requirement Model, Design Model
- 1.5. Fundamentals of Object oriented system analysis and design
- 1.6. Entity Relationship Diagram (E-R Diagram), Context Diagram, Data Flow Diagrams (DFDs), UML diagrams

2. Software Engineering Principles

- 2.1. Software process: The software lifecycle models, risk-driven approaches
- 2.2. Software Project management: Relationship to lifecycle, project planning, project control, project organization, risk management, cost models, configuration management, version control, quality assurance, metrics
- 2.3. Software requirements: Requirements analysis, requirements solicitation, analysis tools, requirements definition, requirements specification, static and dynamic specifications, requirements review
- 2.4. Software design: Design for reuse, design for change, design notations, design evaluation and validation
- 2.5. Software Project Implementation: Programming standards and procedures, modularity, data abstraction, static analysis, unit testing, integration testing, regression testing, tools for testing, fault tolerance

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- 2.6. Software Maintenance: The maintenance problem, the nature of maintenance, planning for maintenance
- 2.7. Tools and environments for software engineering, role of programming paradigm, process maturity and Improvement, ISO standards, SEI-CMM, CASE tools
- 3. MIS and Web Engineering**
 - 3.1. Information Systems, Client-Server Computing
 - 3.2. Information system architecture, Control of Information system
 - 3.3. Web engine architecture
 - 3.4. Database Design issues, Data Mining, Data Warehousing
 - 3.5. Knowledge Management, The strategic use of Information Technology
 - 3.6. Work Process Redesign (Reengineering) with Information Technology, Enterprise Resources Planning Systems, and Global Information Technology issues
 - 3.7. Software Supported Demonstrations including advanced Spreadsheet topics Software Component Based Systems (CBSE)
 - 3.8. Multimedia communications and applications
 - 3.9. Object-Oriented Programming with COMS & DECOMS
 - 3.10. Group Decision Support Systems
 - 3.11. Basics of Website Design, HTML, DHTML, XML
- 4. Computer Graphics**
 - 4.1. Graphics concepts
 - 4.2. Input devices and techniques
 - 4.3. Basic raster graphics algorithms and primitives
 - 4.4. Scan conversion
 - 4.5. Graphics hardware
 - 4.6. 2D geometrical transformations and viewing
 - 4.7. 3D geometry and viewing
 - 4.8. Hierarchical modeling
 - 4.9. Projections
 - 4.10. Hidden surface removal
 - 4.11. Shading and Rendering, Phong Shading, Gouraud Shading

Section	Unit	Multiple Choice Questions(MCQ)	Short Questions	Long Questions
A	1	3	1	1
	2	3	2	
	3	3	1	
	4	3	1	
B	1	3	1	1
	2	3	1	1
	3	4	1	
	4	3	1	
No. of questions		25	9	3
Marks		25×1=25	9×5 =45	3×10=30
Total 100				

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Paper III
Current Developments in IT Sector and Emerging Technologies
Section (A)

- 1. IT in Central Bank (Nepal Rastra Bank) and Nepalese Banking Sector**
 - 1.1. History of Central Bank
 - 1.2. History of IT in Nepalese Banking Sector
 - 1.3. Uses of Computers and Software Development
 - 1.4. Use of IT in Nepalese Banking Sector
 - 1.5. IT risks in Banking Sector and management of these risks
 - 1.6. Information System Audit of Banks
- 2. Relevant Acts, Policies and Guidelines**
 - 2.1. NRB Act, 2058
 - 2.2. Electronic Transaction Act, 2063
 - 2.3. ICT Policy, 2072
 - 2.4. Broadband Policy, 2071
 - 2.5. Satellite Policy, 2077
 - 2.6. NRB IT Guidelines, 2012
- 3. Internet and Network Programming**
 - 3.1. Common Gateway Interface (CGI) application
 - 3.2. Input to CGI: environment variables, accessing from input
 - 3.3. Output from CGI: CGI and response headers
 - 3.4. Forms and CGI: Sending data to the server using HTML tags
 - 3.5. Unix/internet domain socket, Socket Address Structure, Socket system call
 - 3.6. Introduction to JAVA: JAVA evolution, JAVA history, JAVA features, Difference between JAVA and C/C++, Simple JAVA program, JAVA program structure, JAVA Statements
- 4. Cyber Security and Ethics**
 - 4.1. Introduction, Security Technologies
 - 4.2. Information Security and Cryptography
 - 4.3. Legal Issues in Cyber Crime
 - 4.4. Ethics in Cybersecurity & Cyber Law
 - 4.5. Professional and Ethical Responsibilities
 - 4.6. Risks and Liabilities of Computer-Based Systems
- 5. Overview of FinTech, RegTech and SupTech**
 - 5.1. Key technologies of FinTech, API, AI, ML, IoT, Big data analytics, distributed laser technology, smart contracts, cryptography, biometrics
 - 5.2. Areas of RegTech, Identity management and control, risk management, Regulatory reporting, transaction monitoring, Financial market trading
 - 5.3. SupTech supports, Data input, Data pull, Real time access, Reporting utilities, intelligence gathering, data quality management

Section (B)

- 1. E-Commerce Technology**
 - 1.1. Introduction to E-Commerce and M-Commerce
 - 1.2. Electronic Commerce Strategies
 - 1.3. Electronic Commerce Security Issues
 - 1.4. Success Models of E-Governance
 - 1.5. E-Business: B2B, B2C, B2E, C2C, G2G, G2C
 - 1.6. Principles of Electronic Payment, Strategies & Systems
 - 1.7. E-marketing, Reverse Engineering

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- 1.8. E-Banking, EDI Methods, SWIFT
- 1.9. Encryption and Decryption Methods, XML, Layout Managers, Event Model
- 2. E-Governance**
 - 2.1. History of e-Governance development
 - 2.2. e-Governance working principles, Models of e-Governance
 - 2.3. G2G e-Governance; Governance to Business (G2B); Development of G2B Governance
 - 2.4. Global trading environment & adoption of e-Governance
 - 2.5. E-Government life cycle
 - 2.6. Online service delivery and electronic service delivery
 - 2.7. Infrastructure use in e-Governance
 - 2.8. Electronic funds transfer, e-payment gateways, Electronic payment system (EPS)
 - 2.9. Mobile Governance
- 3. Artificial Intelligence and Machine Learning**
 - 3.1. Introduction
 - 3.2. Problem Decomposition and Planning
 - 3.3. Logic and Reasoning
 - 3.4. Natural Language Processing and ANN
 - 3.5. Machine Learning and pattern recognition
- 4. Cloud Computing**
 - 4.1. Basics of Cloud Computing, Characteristics
 - 4.2. Cloud, Fog, Edge computing comparisons, Cloud Federation
 - 4.3. Data Storage and Security in the Cloud
 - 4.4. Virtualization: virtual machines and container technologies
 - 4.5. Ubiquitous Clouds and the Internet of Things
 - 4.6. Future of Cloud Computing, Federated learning
- 5. Development in Virtual Currency**
 - 5.1. History
 - 5.2. Development
 - 5.3. Models
 - 5.4. Risks and Benefits
 - 5.5. Prospects, Challenges

Section	Unit	Multiple Choice Questions (MCQ)	Short Questions	Long Questions
A	1	3	1	
	2	2	1	
	3	2	1	1
	4	3	1	
	5	2	1	
B	1	3		1
	2	3	1	
	3	2	1	1
	4	3	1	
	5	2	1	
No. of questions		25	9	3
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Second Stage: Practical Examination

Topics	Full marks	Pass marks	No. of Questions X Marks	Time
OS (MS Windows) a. Basic Configuration b. Issues and problem resolution c. User/file rights Management	50	25	1x10=10	1 Hour 30 Minutes
Networking d. IP/Subnet/Routing/Gateway concepts. e. Connectivity troubleshooting f. Cisco Device configurations i. IP and Routing ii. VLAN and Switching g. Basic Access control and security			1x10=10	
Database h. Database design with constraints i. SQL			2x10=20	
Programming j. Database connectivity k. C/Java programming l. XML m. PHP Programming			1x10=10	