लोक सेवा आयोग
संघीय संसद सेवा, सूचना प्रविधि समूह, राजपत्रांकित द्वितीय श्रेणी, सिनीयर कम्प्युटर इञ्जिनियर पदको खुला र आन्तरिक प्रतियोगितात्मक परीक्षाको पाठ्यक्रम

द्वितीय पत्र : प्राविधिक विषय

1. **Software Engineering and Quality Assurance**
   - 1.1 Introduction to Software Engineering
   - 1.2 System Development Life Cycle (SDLC)
   - 1.3 Requirement Engineering and Analysis
   - 1.4 System, Data, and Process Modeling (DFD, ERD, UML)
   - 1.5 Software Architecture and Design Patterns
   - 1.6 Software Testing
   - 1.7 Software Quality Assurance (SQA) and Software Metrics
   - 1.8 Software Quality Standards: ISO, SEI CMMI, CASE Tools
   - 1.9 Software Project Management: Estimation (e.g., COCOMO), Scheduling, Risk Management
   - 1.10 Service-Oriented Architecture in Software Development
   - 1.11 Emerging Trends in Software Engineering

2. **Computer Architecture and Organization**
   - 2.1 Introduction to Computer Systems
     - 2.1.1 Digital vs. Analog Systems
     - 2.1.2 RISC vs. CISC Architectures
   - 2.2 Digital Logic Design
     - 2.2.1 Logic Gates and Boolean Algebra
     - 2.2.2 Combinational Circuits: Multiplexers, Demultiplexers, Encoders, Decoders
     - 2.2.3 Sequential Circuits: Flip-Flops, Latches, Counters, and Registers
     - 2.2.4 Arithmetic Circuits: Adders, Subtractors, ALU
   - 2.3 Instruction Set Architecture (ISA)
     - 2.3.1 Instruction Types and Formats
     - 2.3.2 Addressing Modes
     - 2.3.3 Instruction Cycle and Execution Cycle
     - 2.3.4 Instruction Pipelining
   - 2.4 Central Processing Unit (CPU) Organization
     - 2.4.1 CPU Components: ALU, Control Unit, Register Organization
     - 2.4.2 Control Design: Hardwired vs. Microprogrammed Control
     - 2.4.3 Arithmetic and Logic Instructions
   - 2.5 Memory Organization
     - 2.5.1 Memory Hierarchy: Registers, Cache, Main Memory, Secondary Memory
     - 2.5.2 Cache Memory Design: Mapping Techniques and Replacement Policies
     - 2.5.3 Virtual Memory: Paging, Segmentation
   - 2.6 Input / Output Organization
     - 2.6.1 I/O Techniques: Programmed I/O, Interrupt-driven I/O, Direct Memory Access (DMA)
     - 2.6.2 Bus Structures and Data Transfer Protocols

2.7 Performance and Evaluation
- 2.7.1 Performance Metrics: MIPS, FLOPS, CPI

3. **Operating System and Cloud Computing**

3.1 OS Fundamentals and Architecture
- 3.1.1 Overview of OS types and components
- 3.1.2 Functions of Operating System
- 3.1.3 Kernel, shell, system calls, and OS services
- 3.1.4 User interfaces: CLI and GUI
- 3.1.5 Different types of OS (DOS, UNIX, LINUX, WINDOWS)

3.2 Process and Thread Management
- 3.2.1 Process life cycle and process control block
- 3.2.2 Threads, multithreading concepts
- 3.2.3 CPU scheduling algorithms
- 3.2.4 Inter-process communication (IPC) and synchronization
- 3.2.5 Deadlock causes, prevention, detection, and recovery

3.3 Memory Management
- 3.3.1 Memory allocation strategies
- 3.3.2 Paging, segmentation, and virtual memory
- 3.3.3 Page replacement algorithms and thrashing

3.4 File Systems and Storage Management
- 3.4.1 File concepts, organization, and access methods
- 3.4.2 Directory structures and file system implementation
- 3.4.3 Disk scheduling algorithms and RAID levels

3.5 Distributed Operating Systems
- 3.5.1 Distributed OS features and architecture
- 3.5.2 Distributed file systems and synchronization

3.6 Cloud Computing
- 3.6.1 Introduction to Cloud Computing and Service Models
- 3.6.2 Cloud Deployment Models
- 3.6.3 Virtualization and Resource Management
- 3.6.4 Cloud Storage and Data Management
- 3.6.5 Security, Privacy, and Compliance in the Cloud
- 3.6.6 Emerging Trends in Cloud Computing

4. **Information Systems and ICT Project Management**

4.1 Foundations of Information Systems
- 4.1.1 Fundamentals of Information Systems
- 4.1.2 Design and Development of Information Systems
- 4.1.3 Management Information Systems (MIS)
- 4.1.4 Decision Support Systems (DSS)
- 4.1.5 Enterprise Systems (ERP, CRM, SRM)
- 4.1.6 Information Security and Ethical Issues

4.1.7 Emerging Trends in Information Systems

4.2 ICT Project Initiation and Planning

4.2.1 Requirement Engineering in IT Projects

4.2.2 IT Investment and Breakeven Analysis

4.2.3 Time Value of Money in IT Projects

4.2.4 Financial Analysis for IT Project Feasibility

4.2.5 Software Project Estimation Techniques

4.2.6 Project Scheduling (PERT / CPM)

4.3 ICT Project Execution and Control

4.3.1 Software Configuration and Change Management

4.3.2 IT Project Team Building and Human Resource Management

4.3.3 Issue Tracking and Risk Management

4.3.4 Verification, Validation, and Quality Assurance

4.3.5 IT Project Monitoring and Control

4.4 Project Completion and Process Improvement

4.4.1 Project Closure, Evaluation, and Knowledge Management

4.4.2 Business Process Reengineering in IT Context

5. **Computer Networks and Cyber Security**

5.1 Computer Network Fundamentals

5.1.1 Network Concepts and Architectures

5.1.2 OSI and TCP/IP Models

5.1.3 IP Addressing, Subnetting, and Routing Protocols (RIP, OSPF, BGP)

5.1.4 Pv6 addressing, types and features

5.1.5 TCP/IP Services (DNS, FTP, DHCP, SNTP, etc.)

5.1.6 Network Devices and Infrastructures (Routers, Switches, Hubs, etc.)

5.1.7 Value Added Networks (VAN), Remote Access, and Internet Technologies (WWW)

5.1.8 Recent trends in networking: Software-defined networking, data centric networking, name data networking and quantum networking

5.2 Cyber Security Essentials

5.2.1 Introduction to Cyber Security: Goals and Threat Landscape

5.2.2 Network Security Mechanisms (Firewalls, IDS/IPS, VPNs)

5.2.3 Cryptography: Symmetric, Asymmetric, Hashing, Digital Signatures

5.2.4 Authentication, Authorization, and Access Control

5.2.5 Security Policies, Risk Assessment, and Compliance

5.2.6 Cyber Threats and Mitigation (Malware, Phishing, DDoS, etc.)

5.2.7 Data Privacy and Security in Cloud and Web Systems

5.2.8 Disaster Recovery, Incident Response, and Business Continuity

6. **Database Management System**

6.1 Database Models

6.2 DBMS Architecture

6.3 Entity-Relationship (ER) Modeling and Database Design
6.4 Relational Algebra and Relational Calculus
6.5 Structured Query Language (SQL)
6.6 NoSQL
6.7 Functional Dependency and Data Integrity Constraints
6.8 Normalization
6.9 File Organization and Storage Management
6.10 Indexing and Hashing
6.11 Transaction Management and Concurrency Control
6.12 Query Processing and Optimization
6.13 Security, Authorization, and Data Integrity
6.14 Backup and Recovery
6.15 Overview of Major DBMS Products (Oracle, DB2, MySQL, MSSQL Server, MongoDB, etc.)

7. **IT Strategy and Governance**

7.1 Introduction to Strategic Management
- 7.1.1 Concept and importance of strategic management in IT
- 7.1.2 Components: Strategic planning, implementation, and control
- 7.1.3 External Environment Analysis: PESTLE, Porter's Five Forces, Scenario Planning
- 7.1.4 Internal Environment Analysis: Value chain, core competencies
- 7.1.5 SWOT Analysis

7.2 IT Governance and Policy
- 7.2.1 Role of IT in business strategy
- 7.2.2 Role of Senior Computer Engineer in strategic alignment
- 7.2.3 IT strategic planning process
- 7.2.4 IT governance frameworks (e.g., COBIT, ISO)
- 7.2.5 Regulatory compliance, policy development and IT audit
- 7.2.6 Decision rights and accountability structures
- 7.2.7 IT portfolio and enterprise architecture (EA)
- 7.2.8 Data governance and Master Data Management (MDM)
- 7.2.9 Data privacy and ethical considerations

7.3 IT Service and Risk Management
- 7.3.1 IT service management and lifecycle
- 7.3.2 Service Level Agreements (SLAs) and vendor management
- 7.3.3 IT operations and infrastructure strategy
- 7.3.4 IT procurement and outsourcing
- 7.3.5 Risk assessment and mitigation
- 7.3.6 Business continuity and disaster recovery (BC/DR)
- 7.3.7 Cybersecurity governance
- 7.3.8 Introduction to standards: NIST, ISO 27001, GDPR

7.4 Leadership and Change Management

7.4.1 Leading digital transformation
7.4.2 Organizational structures for strategy execution
7.4.3 Managing strategic change: diagnosis, implementation, levels of change
7.4.4 Strategic and operational control: performance measurement and evaluation
7.4.5 Communication strategies for IT leaders
7.4.6 Talent development and team leadership

8. **E-Commerce Technology**
8.1 Introduction to E-Commerce
8.2 E-Commerce Business Models (B2B, B2C, C2C, C2B, G2C)
8.3 B2B E-Commerce and Electronic Data Interchange (EDI)
8.4 Applications of E-Commerce in Business (Marketing, Sales, Supply Chain, CRM)
8.5 Electronic Payment Systems (Credit/Debit cards, Digital Wallets, Mobile Payments, etc.)
8.6 E-Commerce Security Issues
8.7 Symmetric and Asymmetric Encryption/Decryption
8.8 Public Key Infrastructure (PKI) and Digital Signatures
8.9 Legal, Ethical, and Regulatory Issues in E-Commerce
8.10 Trends in E-Commerce

9. **E-Government**
9.1 Introduction to E-Government
9.2 Managing Public Data
9.3 Implementing E-Government
9.4 Emerging Issues in E-Government
9.4.1 Digital divide and accessibility
9.4.2 Interoperability and standards
9.4.3 Citizen-centric services and digital inclusion
9.4.4 Use of emerging technologies in E-goverment
9.5 Nepalese E-Government Initiatives
9.6 Government Enterprise Architecture
9.7 Government Integrated Data Centers
9.8 Related Agencies for E-Government in Nepal

10. **Emerging Technology in IT**
10.1 Data Mining and Warehousing
10.2 Big Data Analytics
10.3 Internet of Things (IoT)
10.4 Machine Learning and Artificial Intelligence
10.5 Blockchain Technology

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