गुठी संस्थान
विविध सेवा, सूचना प्रविधि समूह, अधिकृत तृतीय श्रेणी, सूचना प्रविधि अधिकृत पदको खुला तथा आन्तरिक प्रतियोगितात्मक परीक्षाको पाठ्यक्रम

पाठ्यक्रमको रुपरेखा :– यस पाठ्यक्रमको आधारमा निम्नानुसारका चरणमा परीक्षा लिइने छ :

प्रथम चरण :–	लिखित परीक्षा (Written Examination)	पूर्णाङ्क :– २००
द्वितीय चरण :–	अन्तर्वार्ता (Interview)	पूर्णाङ्क :– ३०

परीक्षा योजना (Examination Scheme)

प्रथम चरण : लिखित परीक्षा (Written Examination)   पूर्णाङ्क :– २००

पत्र	विषय	खण्ड	पूर्णाङ्क	उत्तीर्णाङ्क	परीक्षा प्रणाली		प्रश्नसंख्या ×अङ्क	समय
प्रथम	General Subject	Part I: General Awareness & General Reasoning Test	१००	४०	वस्तुगत (Objective)	बहुवैकल्पिक प्रश्न (MCQs)	५० प्रश्न × १ अङ्क	१घण्टा ३० मिनेट
		Part II: General Technical Subject					५० प्रश्न × १ अङ्क	
द्वितीय	Technical Subject		१००	४०	विषयगत (Subjective)	छोटो उत्तर लामो उत्तर	४ प्रश्न × ५ अङ्क ८ प्रश्न × १०अङ्क	३ घण्टा

द्वितीय चरण : अन्तर्वार्ता (Interview)   पूर्णाङ्क :– ३०

पत्र / विषय	पूर्णाङ्क	उत्तीर्णाङ्क	परीक्षा प्रणाली	समय
अन्तर्वार्ता (Interview)	३०		बोर्ड अन्तर्वार्ता(Board Interview)	-

द्रष्टव्य :

१. लिखित परीक्षाको माध्यम भाषा नेपाली वा अंग्रेजी अथवा नेपाली र अंग्रेजी दुबै हुनेछ ।

२. प्रथमपत्र र द्वितीयपत्रको लिखित परीक्षा छुट्टाछुट्टै हुनेछ ।

३. वस्तुगत बहुवैकल्पिक (Multiple Choice) प्रश्नको गलत उत्तर दिएमा प्रत्येक गलत उत्तर बापत २० प्रतिशत अङ्क कट्टा गरिनेछ । तर उत्तर नदिएमा त्यस वापत अङ्क दिइने छैन र अङ्क कट्टा पनि गरिने छैन ।

४. वस्तुगत बहुवैकल्पिक परीक्षामा परीक्षार्थील उत्तर लेख्दा अंग्रेजी ठूलो अक्षरहरु (Capital letters): A, B, C, D मा लेख्नुपर्नेछ । सानो अक्षरहरू (Small letters): a, b, c, d लेखेका वा अन्य कुनै सङ्केत गरेका भए सबै उत्तरपुस्तिका रद्द हुनेछ ।

५. बहुवैकल्पिक प्रश्न हुने परीक्षामा कुनै प्रकारको क्याल्कुलेटर (Calculator) प्रयोग गर्न पाइने छैन ।

६. विषयगत प्रश्नको हकमा तोकिएको अंककको एउटा लामो प्रश्न वा एउटै प्रश्नका दुई वा दुई भन्दा बढी भाग (Two or more parts of a single question) वा एउटा प्रश्न अन्तर्गत दुई वा बढी टिप्पणीहरू (Short notes) सोध्न सकिने छ ।

७. द्वितीय पत्रमा (विषयगत प्रश्न हुनका हकमा) प्रत्येक खण्डका लागि छुट्टाछुट्टै उत्तरपुस्तिकाहरू हुनेछन् । परीक्षार्थीले प्रत्येक खण्डका प्रश्नको उत्तर सोहीखण्डको उत्तरपुस्तिकामा लेख्नुपर्नेछ ।

८. यस पाठ्यक्रम योजना अन्तर्गतका पत्र ⁄ विषयका विषयवस्तुमा जेसुकै लेखिएको भए तापनि पाठ्यक्रममा परेका कानून, ऐन, नियम तथा नीतिहरू परीक्षाको मिति भन्दा ३ महिना अगाडि (संशोधन भएका वा संशोधन भई हटाईएका वा थप गरी संशोधन भई) कायम रहेकालाई यस पाठ्यक्रममा परेको सम्झनु पर्दछ ।

९. प्रथमचरणको परीक्षाबाट छनौट भएका उम्मेदवारहरूलाई मात्र द्वितीयचरणको परीक्षामा सम्मिलित गराइनेछ ।

१०. पाठ्यक्रम स्वीकृत मिति : - २०८२/०३/२५

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प्रथम पत्र (Paper I)

General Subject

Part (I) : - General Awareness & General Reasoning Test (50 Marks)

1. **General Awareness and Contemporary Issues**   (25 Question ×1 Mark = 25 Marks)

    1.1 Physical, socio-cultural and economic geography and demography of Nepal

    1.2 Major natural resources of Nepal

    1.3 Geographical diversity, climatic conditions, and livelihood & lifestyle of people

    1.4 Notable events and personalities, social, cultural and economic conditions in modern history of Nepal

    1.5 Current periodical plan of Nepal

    1.6 Information on sustainable development, environment, pollution, climate change, biodiversity, science and technology

    1.7 Nepal's international affairs and general information on the UNO, SAARC & BIMSTEC

    1.8 The Constitution of Nepal (From Part 1 to 5 and Schedules)

    1.9 Governance system and Government (Federal, Provincial and Local)

    1.10 Provisions of civil service act and regulation relating to constitution of civil service, organizational structure, posts of service, fulfillment of vacancy and code of conduct

    1.11 Functional scope of public services

    1.12 Public Service Charter

    1.13 Concept, objective and importance of public policy

    1.14 Fundamentals of management: planning, organizing, directing, controlling, coordinating, decision making, motivation and leadership

    1.15 Government planning, budgeting and accounting system

    1.16 Major events and current affairs of national and international importance

2. **General Reasoning Test**   (25 Question ×1 Mark = 25 Marks)

    2.1 Logical Reasoning (9×1 Mark = 9 Marks)

    Verbal Ability, Alphanumeric Series, Reasoning Analogies, Classification, Coding-Decoding, Order & Ranking, Distance & Directions, Analytical and Logical Reasoning, Assertion and Reason, Statement and Conclusion, Input Output, Venn- diagram

    2.2 Numerical Reasoning (8×1 Mark = 8 Marks)

    Arithmetic Series, Analogy, Classification, Arithmetical Reasoning, Fraction. Percentage, Ratio, Average, Profit & Loss, Time & Work, Date & Calendar, Data Sufficiency, Data Interpretation & Data Verification

    2.3 Spatial Reasoning (8×1 Mark = 8 Marks)

    Figure Series, Figure Analogy, Figure Classification, Figure Matrix, Pattern Completion, Embedded Images, Image Formation & Analysis, Mirror and Water Images, Cubes and Dices, Paper Folding & Cutting

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Part (II): - General Technical Subject (50 Marks)

1. Computer Fundamentals   **(5 Question ×1 Mark = 5 Marks)**

1.1 Computer: Definition, History, Generations, Characteristics, Types and Applications

1.2 Overview of a Computer System

    1.2.1   Data and Data Processing

    1.2.2   Hardware

        1.2.2.1 Definition of Hardware

        1.2.2.2 Input Unit: Keyboard, Mouse, Scanner, etc.

        1.2.2.3 CPU: Arithmetic Logic Unit (ALU), Control Unit (CU), Memory Unit

        1.2.2.4 Output Unit: Monitor, Printer, etc.

        1.2.2.5 Storage Devices: Primary and Auxiliary Memory, Examples: Floppy Disk, Hard Disk, Compact Disk, DVD, Super Disks, Zip Disks, Cartridge Tape, Flash Disks, etc.

        1.2.2.6 Other Devices: Network Card, Modem, Sound Card, etc.

    1.2.3   Definition and Types of Software

    1.2.4   Liveware

    1.2.5   Firmware and Cache Memory

1.3 Setting and Protection of Computer Room and Computer

1.4 Computer-Related Threats: Viruses, Worms, Trojans, Phishing, Remedies and Protection Measures

1.5 Concept of Multimedia

1.6 ASCII, Unicode and Font Types

1.7 Number System: Binary, Octal, Decimal, Hexadecimal, Conversions between systems

1.8 Security

    1.8.1   Physical Security of IT Infrastructure

    1.8.2   Digital Security: Antivirus, Firewalls, Antispyware, User Authentication Types, IPS/IDS

    1.8.3   Common Security Threats: Social Engineering, Malware, Phishing, Spyware, Viruses, worms, Trojans, Distributed Denial of Service (DDoS) Attacks

2. Data Structures and Algorithms   **(5 Question ×1 Mark = 5 Marks)**

  2.1 Fundamentals

    2.1.1   Introduction to Data Structures

    2.1.2   Abstract Data Types (ADT)

    2.1.3   Operations on Data Structures

    2.1.4   Classification of Data Structures: Linear and Non-linear, Static and Dynamic

2.2 Linear Data Structures

    2.2.1   Arrays: Representation, advantages, and limitations

    2.2.2   Linked Lists: Singly, Doubly, and Circular

    2.2.3   Stacks: Operations, implementation, applications

    2.2.4   Queues: Simple Queue, Circular Queue, Double Ended Queue (Deque)

    2.2.5   Priority Queues and Heaps: Min-heap, Max-heap, applications

2.3 Non-Linear Data Structures

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2.3.1 Trees:

    2.3.1.1 Terminologies and properties

    2.3.1.2 Binary Trees and their traversals (In order, Pre order, Post order)

    2.3.1.3 Binary Search Trees (BST)

    2.3.1.4 Balanced Trees (AVL Trees, Red-Black Trees)

    2.3.1.5 Heaps and Heap Operations

2.3.2 Graphs:

    2.3.2.1 Representation

    2.3.2.2 Types of Graphs

    2.3.2.3 Graph Traversal: Depth-First Search (DFS), Breadth-First Search (BFS)

    2.3.2.4 Shortest Path Algorithms

    2.3.2.5 Minimum Spanning Trees

    2.3.2.6 Directed Acyclic Graphs (DAGs), Topological Sorting

2.4 Indexing and Hashing

    2.4.1 Hashing Techniques and Hash Functions

    2.4.2 Collision Resolution Methods

    2.4.3 Applications of Hashing

2.5 Searching and Sorting Algorithms

    2.5.1 Linear Search, Binary Search

    2.5.2 Merge Sort, Quick Sort, Insertion Sort, Selection Sort, Heap Sort

    2.5.3 Comparison of Sorting Techniques (Time and Space complexity)

2.6 Algorithm Analysis

    2.6.1 Time and Space Complexity

    2.6.2 Asymptotic Notations: Big O, Omega, and Theta

    2.6.3 Worst-case, Best-case, Average-case Analysis

    2.6.4 Amortized Analysis

2.7 Algorithmic Techniques

    2.6.5 Divide and Conquer

    2.6.6 Dynamic Programming

    2.6.7 Greedy Algorithms

3. Programming Languages   **(5 Question ×1 Mark = 5 Marks)**

3.1 Introduction

    3.1.1 History of Programming Languages

    3.1.2 Programming Paradigms: Procedural, Structured, Object-Oriented, Functional

    3.1.3 Role of Compilers, Interpreters, and Translators

3.2 Programming Fundamentals

    3.2.1 Data Types, Variables, Constants

    3.2.2 Operators and Expressions

    3.2.3 Input and Output Functions

3.3 Control Structures

    3.3.1 Conditional Statements: if, if-else, switch

    3.3.2 Looping Structures: for, while, do-while

    3.3.3   break, continue, exit statements

  3.4 Functions and Modularity

    3.4.1   Function Definitions and Calls

    3.4.2   Pass by Value and Pass by Reference

    3.4.3   Recursion and its applications

    3.4.4   Modular Programming and Code Reusability

  3.5 Arrays, Strings and Structures

    3.5.1   One-dimensional and Multi-dimensional Arrays

    3.5.2   String Handling and String Functions

    3.5.3   Structures and Unions

  3.6 Pointers and Memory Management

    3.6.1   Basics of Pointers and Pointer Arithmetic

    3.6.2   Dynamic Memory Allocation: malloc, calloc, free

    3.6.3   Use of Pointers in Arrays and Functions

  3.7 Object-Oriented Programming (OOP)

    3.7.1   Classes and Objects

    3.7.2   Encapsulation, Inheritance, Polymorphism

    3.7.3   Method Overloading and Overriding

    3.7.4   Constructors and Destructors

    3.7.5   Exception Handling

  3.8 File Handling

    3.8.1   File Operations in C/C++

    3.8.2   File Streams in Java

  3.9 Program development using C, C++ and Java

4. **System Analysis and Design**   **(5 Question ×1 Mark = 5 Marks)**

    4.1   System and its stakeholders: Owner, User, Designer, Builder, Analyst

    4.2   Joint Application Development (JAD): Definition, Scope, Philosophy

    4.3   JAD Participants: Sponsor, Users, Analysts

    4.4   Roles in JAD: Project Leader, Recorder, Timekeeper

    4.5   Design Environment: Development and Management Processes, System Structure

    4.6   Concept Formation: Problem Definition, Proposal Evaluation, Types of Feasibility

    4.7   Requirements Analysis: System Models, Requirement Models, Design Models

    4.8   Software Development Models: Waterfall, Prototype, Spiral, Agile

    4.9   Data Flow Diagrams (DFD): Symbols, Data Flows, External Entities

    4.10 DFD Examples: Context Diagram, Top-Level DFD, Expanded DFD

    4.11 Object Modeling: OOP Concepts, Structure, Classes and Objects

    4.12 Representation: Association, Composition, Inheritance

    4.13 Modeling Diagrams: Use Case Diagrams, State Diagrams, Event Flow Diagrams

    4.14 Documentation: Automatic and Manual Documentation Systems

    4.15 Software Testing

5. Operating Systems   (5 Question ×1 Mark = 5 Marks)

     5.1 Definition, development, and functions

     5.2 Storage, memory management

     5.3 Disk allocation/scheduling, virtual memory

     5.4 Process definition, scheduling, IPC, deadlocks

     5.5 Parallel and distributed processing, OS security threats

     5.6 MS-DOS overview

     5.7 Windows, Unix, Linux overview

     5.8 Windows networking introduction

     5.9 Windows and Linux architecture

     5.10 Troubleshooting Windows & Linux

     5.11 Managing printers, hard disks, partitions

     5.12 Monitoring/troubleshooting Windows

     5.13 User/group permissions (Windows/Linux)

6. Compiler Design   (2 Question ×1 Mark = 2 Marks)

     6.1 Introduction to compilers

     6.2 Lexical, syntax, and semantic analysis

     6.3 Runtime environment

     6.4 Intermediate code generation, optimization

     6.5 Compiler generation tools

7. Database Management Systems (DBMS)   (3 Question ×1 Mark = 3 Marks)

     7.1 Database Models

     7.2 DBMS Architecture

     7.3 Entity-Relationship (ER) Modeling and Database Design

     7.4 Relational Algebra and Relational Calculus

     7.5 Structured Query Language (SQL)

     7.6 NoSQL

     7.7 Functional Dependency and Data Integrity Constraints

     7.8 Normalization

     7.9 File Organization and Storage Management

     7.10 Indexing and Hashing

     7.11 Transaction Management and Concurrency Control

     7.12 Query Processing and Optimization

     7.13 Security, Authorization, and Data Integrity

     7.14 Backup and Recovery

     7.15 Overview of Major DBMS Products (Oracle, DB2, MySQL, MSSQL Server, MongoDB, etc.)

8. Computer Networking and Cyber Security   (4 Question ×1 Mark = 4 Marks)

     8.1 Network models (OSI, TCP/IP),

     8.2 Addressing (IP, MAC)

8.3 Network connectivity: Packets, devices (hubs, switches, routers), noise/error control

8.4 Ethernet, token ring, wireless technologies

8.5 Protocols: NetBEUI, TCP/IP suite, SNMP, FTP

8.6 TCP/IP services: DHCP, DNS, NetBIOS

8.7 LAN infrastructure: Protocols, routing, VLANs

8.8 WAN infrastructure: Technologies, devices, VoIP

8.9 Remote networking: Remote access protocols, VPN

8.10 Security: Viruses, malware, access control, network security basics

8.11 Disaster recovery: Plans, backups, fault tolerance

8.12 Storage: NAS, SAN, clustering

8.13 Troubleshooting: Systematic approach, tools

8.14 Network components: Ports, access points, peripherals

8.15 Introduction to Cyber Security: Goals and Threat Landscape

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

8.17 Cryptography: Symmetric, Asymmetric, Hashing, Digital Signatures

8.18 Authentication, Authorization, and Access Control

8.19 Security Policies, Risk Assessment, and Compliance

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

8.21 Data Privacy and Security in Cloud and Web Systems

8.22 Disaster Recovery, Incident Response, and Business Continuity

9. **Computer Architecture and Organization**   **(4 Question ×1 Mark = 4 Marks)**

9.1 Introduction to Computer Systems

   9.1.1 Digital vs. Analog Systems

   9.1.2 RISC vs. CISC Architectures

9.2 Digital Logic Design

   9.2.1 Logic Gates and Boolean Algebra

   9.2.2 Combinational Circuits: Multiplexers, Demultiplexers, Encoders, Decoders

   9.2.3 Sequential Circuits: Flip-Flops, Latches, Counters, and Registers

   9.2.4 Arithmetic Circuits: Adders, Subtractors, ALU

9.3 Instruction Set Architecture (ISA)

   9.3.1 Instruction Types and Formats

   9.3.2 Addressing Modes

   9.3.3 Instruction Cycle and Execution Cycle

   9.3.4 Instruction Pipelining

9.4 Central Processing Unit (CPU) Organization

   9.4.1 CPU Components: ALU, Control Unit, Register Organization

   9.4.2 Control Design: Hardwired vs. Microprogrammed Control

   9.4.3 Arithmetic and Logic Instructions

9.5 Input / Output Organization

   9.5.1 I/O Techniques: Programmed I/O, Interrupt-driven I/O, Direct Memory Access (DMA)

    9.5.2   Bus Structures and Data Transfer Protocols

10. E-Commerce Technology   (3 Question ×1 Mark = 3 Marks)

    10.1 Introduction to E-Commerce

    10.2 E-Commerce Business Models (B2B, B2C, C2C, C2B, G2C)

    10.3 B2B E-Commerce and Electronic Data Interchange (EDI)

    10.4 Applications of E-Commerce in Business (Marketing, Sales, Supply Chain, CRM, etc.)

    10.5 Electronic Payment Systems (Credit/Debit cards, Digital Wallets, Mobile Payments, etc.)

    10.6 E-Commerce Security Issues

    10.7 Legal, Ethical, and Regulatory Issues in E-Commerce

    10.8 Trends in E-Commerce

11. Information Systems   (3 Question ×1 Mark = 3 Marks)

    11.1   Fundamentals of Information Systems

    11.2   Design and Development of Information Systems

    11.3   Management Information Systems (MIS)

    11.4   Decision Support Systems (DSS)

    11.5   Enterprise Systems (ERP, CRM, SRM)

    11.6   Information Security and Ethical Issues

    11.7   Emerging Trends in Information Systems

12. Emerging Technology in IT   (3 Question ×1 Mark = 3 Marks)

    12.1   Data Mining and Warehousing

    12.2   Cloud Computing

    12.3   Distributed Systems

    12.4   Big Data Analytics

    12.5   Internet of Things (IoT)

    12.6   Machine Learning and Artificial Intelligence

    12.7   Blockchain Technology

13. IT in Nepal and related organization   (3 Question ×1 Mark = 3 Marks)

    13.1   History of IT in Nepal

    13.2   Electronic Transaction Act, 2063

    13.3   Electronic Transaction Rules, 2064

    13.4   Copyright Act, 2059 & Copyright rules, 2061

    13.5   ICT Policy, 2072

    13.6   National Cyber Security Policy, 2023

    13.7   IT Related government agencies in Nepal

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द्वितीय पत्र **(Paper II)**
Technical Subject

Section A- 50 Marks

1. **Computer Fundamentals**

1.1 Computer: Definition, History, Generations, Characteristics, Types and Applications

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1.8 Security

    1.8.1   Physical Security of IT Infrastructure

    1.8.2   Digital Security: Antivirus, Firewalls, Antispyware, User Authentication Types, IPS/IDS

    1.8.3   Common Security Threats: Social Engineering, Malware, Phishing, Spyware, Viruses, worms, Trojans, Distributed Denial of Service (DDoS) Attacks

2. **Data Structures and Algorithms**

  2.1 Fundamentals

    2.1.1   Introduction to Data Structures

    2.1.2   Abstract Data Types (ADT)

    2.1.3   Operations on Data Structures

    2.1.4   Classification of Data Structures: Linear and Non-linear, Static and Dynamic

2.2 Linear Data Structures

    2.2.1   Arrays: Representation, advantages, and limitations

    2.2.2   Linked Lists: Singly, Doubly, and Circular

    2.2.3   Stacks: Operations, implementation, applications

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2.2.4   Queues: Simple Queue, Circular Queue, Double Ended Queue (Deque)

2.2.5   Priority Queues and Heaps: Min-heap, Max-heap, applications

2.3 Non-Linear Data Structures

    2.3.1   Trees:

        2.3.1.1   Terminologies and properties

        2.3.1.2   Binary Trees and their traversals (In order, Pre order, Post order)

        2.3.1.3   Binary Search Trees (BST)

        2.3.1.4   Balanced Trees (AVL Trees, Red-Black Trees)

        2.3.1.5   Heaps and Heap Operations

    2.3.2   Graphs:

        2.3.2.1   Representation

        2.3.2.2   Types of Graphs

        2.3.2.3   Graph Traversal: Depth-First Search (DFS), Breadth-First Search (BFS)

        2.3.2.4   Shortest Path Algorithms

        2.3.2.5   Minimum Spanning Trees

        2.3.2.6   Directed Acyclic Graphs (DAGs), Topological Sorting

2.4 Indexing and Hashing

    2.4.1   Hashing Techniques and Hash Functions

    2.4.2   Collision Resolution Methods

    2.4.3   Applications of Hashing

2.5 Searching and Sorting Algorithms

    2.5.1   Linear Search, Binary Search

    2.5.2   Merge Sort, Quick Sort, Insertion Sort, Selection Sort, Heap Sort

    2.5.3   Comparison of Sorting Techniques (Time and Space complexity)

2.6 Algorithm Analysis

    2.6.1   Time and Space Complexity

    2.6.2   Asymptotic Notations: Big O, Omega, and Theta

    2.6.3   Worst-case, Best-case, Average-case Analysis

    2.6.4   Amortized Analysis

2.7 Algorithmic Techniques

    2.6.5   Divide and Conquer

    2.6.6   Dynamic Programming

    2.6.7   Greedy Algorithms

3.   Programming Languages

3.1 Introduction

    3.1.1   History of Programming Languages

    3.1.2   Programming Paradigms: Procedural, Structured, Object-Oriented, Functional

    3.1.3   Role of Compilers, Interpreters, and Translators

3.2   Programming Fundamentals

    3.2.1   Data Types, Variables, Constants

    3.2.2   Operators and Expressions

    3.2.3   Input and Output Functions

3.3 Control Structures

3.3.1 Conditional Statements: if, if-else, switch

3.3.2 Looping Structures: for, while, do-while

3.3.3 break, continue, exit statements

3.4 Functions and Modularity

3.4.1 Function Definitions and Calls

3.4.2 Pass by Value and Pass by Reference

3.4.3 Recursion and its applications

3.4.4 Modular Programming and Code Reusability

3.5 Arrays, Strings and Structures

3.5.1 One-dimensional and Multi-dimensional Arrays

3.5.2 String Handling and String Functions

3.5.3 Structures and Unions

3.6 Pointers and Memory Management

3.6.1 Basics of Pointers and Pointer Arithmetic

3.6.2 Dynamic Memory Allocation: malloc, calloc, free

3.6.3 Use of Pointers in Arrays and Functions

3.7 Object-Oriented Programming (OOP)

3.7.1 Classes and Objects

3.7.2 Encapsulation, Inheritance, Polymorphism

3.7.3 Method Overloading and Overriding

3.7.4 Constructors and Destructors

3.7.5 Exception Handling

3.8 File Handling

3.8.1 File Operations in C/C++

3.8.2 File Streams in Java

3.9 Program development using C, C++ and Java

4. **System Analysis and Design**

4.1 System and its stakeholders: Owner, User, Designer, Builder, Analyst

4.2 Joint Application Development (JAD): Definition, Scope, Philosophy

4.3 JAD Participants: Sponsor, Users, Analysts

4.4 Roles in JAD: Project Leader, Recorder, Timekeeper

4.5 Design Environment: Development and Management Processes, System Structure

4.6 Concept Formation: Problem Definition, Proposal Evaluation, Types of Feasibility

4.7 Requirements Analysis: System Models, Requirement Models, Design Models

4.8 Software Development Models: Waterfall, Prototype, Spiral, Agile

4.9 Data Flow Diagrams (DFD): Symbols, Data Flows, External Entities

4.10 DFD Examples: Context Diagram, Top-Level DFD, Expanded DFD

4.11 Object Modeling: OOP Concepts, Structure, Classes and Objects

4.12 Representation: Association, Composition, Inheritance

4.13 Modeling Diagrams: Use Case Diagrams, State Diagrams, Event Flow Diagrams

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4.14 Documentation: Automatic and Manual Documentation Systems

4.15 Software Testing

5. Operating Systems

5.1 Definition, development, and functions

5.2 Storage, memory management

5.3 Disk allocation/scheduling, virtual memory

5.4 Process definition, scheduling, IPC, deadlocks

5.5 Parallel and distributed processing, OS security threats

5.6 MS-DOS overview

5.7 Windows, Unix, Linux overview

5.8 Windows networking introduction

5.9 Windows and Linux architecture

5.10 Troubleshooting Windows & Linux

5.11 Managing printers, hard disks, partitions

5.12 Monitoring/troubleshooting Windows

5.13 User/group permissions (Windows/Linux)

6. Compiler Design

6.1 Introduction to compilers

6.2 Lexical, syntax, and semantic analysis

6.3 Runtime environment

6.4 Intermediate code generation, optimization

6.5 Compiler generation tools

Section B- 50 Marks

7. Database Management Systems (DBMS)

7.1 Database Models

7.2 DBMS Architecture

7.3 Entity-Relationship (ER) Modeling and Database Design

7.4 Relational Algebra and Relational Calculus

7.5 Structured Query Language (SQL)

7.6 NoSQL

7.7 Functional Dependency and Data Integrity Constraints

7.8 Normalization

7.9 File Organization and Storage Management

7.10 Indexing and Hashing

7.11 Transaction Management and Concurrency Control

7.12 Query Processing and Optimization

7.13 Security, Authorization, and Data Integrity

7.14 Backup and Recovery

7.15 Overview of Major DBMS Products (Oracle, DB2, MySQL, MSSQL Server, MongoDB, etc.)

8. Computer Networking and Cyber Security

8.1 Network models (OSI, TCP/IP),

8.2 Addressing (IP, MAC)

8.3 Network connectivity: Packets, devices (hubs, switches, routers), noise/error control

8.4 Ethernet, token ring, wireless technologies

8.5 Protocols: NetBEUI, TCP/IP suite, SNMP, FTP

8.6 TCP/IP services: DHCP, DNS, NetBIOS

8.7 LAN infrastructure: Protocols, routing, VLANs

8.8 WAN infrastructure: Technologies, devices, VoIP

8.9 Remote networking: Remote access protocols, VPN

8.10   Security: Viruses, malware, access control, network security basics

8.11   Disaster recovery: Plans, backups, fault tolerance

8.12   Storage: NAS, SAN, clustering

8.13   Troubleshooting: Systematic approach, tools

8.14   Network components: Ports, access points, peripherals

8.15   Introduction to Cyber Security: Goals and Threat Landscape

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

8.17   Cryptography: Symmetric, Asymmetric, Hashing, Digital Signatures

8.18   Authentication, Authorization, and Access Control

8.19   Security Policies, Risk Assessment, and Compliance

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

8.21   Data Privacy and Security in Cloud and Web Systems

8.22   Disaster Recovery, Incident Response, and Business Continuity

9. Computer Architecture and Organization

9.1 Introduction to Computer Systems

   9.1.1   Digital vs. Analog Systems

   9.1.2   RISC vs. CISC Architectures

9.2 Digital Logic Design

   9.2.1   Logic Gates and Boolean Algebra

   9.2.2   Combinational Circuits: Multiplexers, Demultiplexers, Encoders, Decoders

   9.2.3   Sequential Circuits: Flip-Flops, Latches, Counters, and Registers

   9.2.4   Arithmetic Circuits: Adders, Subtractors, ALU

9.3 Instruction Set Architecture (ISA)

   9.3.1   Instruction Types and Formats

   9.3.2   Addressing Modes

   9.3.3   Instruction Cycle and Execution Cycle

   9.3.4   Instruction Pipelining

9.4 Central Processing Unit (CPU) Organization

   9.4.1   CPU Components: ALU, Control Unit, Register Organization

   9.4.2   Control Design: Hardwired vs. Microprogrammed Control

   9.4.3   Arithmetic and Logic Instructions

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9.5 Input / Output Organization

    9.5.1   I/O Techniques: Programmed I/O, Interrupt-driven I/O, Direct Memory Access (DMA)

    9.5.2   Bus Structures and Data Transfer Protocols

10. E-Commerce Technology

    10.1   Introduction to E-Commerce

    10.2   E-Commerce Business Models (B2B, B2C, C2C, C2B, G2C)

    10.3   B2B E-Commerce and Electronic Data Interchange (EDI)

    10.4   Applications of E-Commerce in Business (Marketing, Sales, Supply Chain, CRM, etc.)

    10.5   Electronic Payment Systems (Credit/Debit cards, Digital Wallets, Mobile Payments, etc.)

    10.6   E-Commerce Security Issues

    10.7   Legal, Ethical, and Regulatory Issues in E-Commerce

    10.8   Trends in E-Commerce

11. Information Systems

    11.1   Fundamentals of Information Systems

    11.2   Design and Development of Information Systems

    11.3   Management Information Systems (MIS)

    11.4   Decision Support Systems (DSS)

    11.5   Enterprise Systems (ERP, CRM, SRM)

    11.6   Information Security and Ethical Issues

    11.7   Emerging Trends in Information Systems

12. Emerging Technology in IT

    12.1   Data Mining and Warehousing

    12.2   Cloud Computing

    12.3   Distributed Systems

    12.4   Big Data Analytics

    12.5   Internet of Things (IoT)

    12.6   Machine Learning and Artificial Intelligence

    12.7   Blockchain Technology

13. IT in Nepal and related organization

    13.1   History of IT in Nepal

    13.2   Electronic Transaction Act, 2063

    13.3   Electronic Transaction Rules, 2064

    13.4   Copyright Act, 2059 & Copyright rules, 2061

    13.5   ICT Policy, 2072

    13.6   National Cyber Security Policy, 2023

    13.7   IT Related government agencies in Nepal