नेपाल इन्जिनियरिङ्ग परिषद्

प्राविधिक सेवा, इन्जिनियरिङ्ग समूह, अधिकृत सातौं तह, कम्प्युटर इन्जिनियर पदको प्रतियोगितात्मक परीक्षाको पाठ्यक्रम

पाठ्यक्रम योजनालाई निम्नानुसारका दुई चरणमा विभाजन गरिएको छ :

प्रथम चरण :– लिखित परीक्षा पूर्णाङ्क :– २००

द्वितीय चरण :– अन्तर्वार्ता पूर्णाङ्क :– ३०

परीक्षा योजना (Examination Scheme)

१. प्रथम चरण : – लिखित परीक्षा **पूर्णाङ्कः– २००**

पत्र	विषय	खण्ड	पूर्णाङ्क	उतीर्णाङ्क	परीक्षा प्रणाली		प्रश्नसंख्या x अङ्क	समय
प्रथम	General Subject	Part I: General Technical Subject	१००	४०	वस्तुगत	बहुवैकल्पिक प्रश्न (MCQ)	७० प्रश्न X १ अङ्क = ७०	१ घण्टा ३० मिनेट
		Part II: General Awareness, Institutional Knowledge and General Reasoning Test					३० प्रश्न X १ अङ्क = ३०	
द्वितीय	Technical Subject		१००	४०	विषयगत	छोटो उत्तर लामो उत्तर	४ प्रश्न X ५ अङ्क = २० ८ प्रश्न X १० अङ्क = ८०	३ घण्टा

२. द्वितीय चरण : – अन्तर्वार्ता **पूर्णाङ्क :– ३०**

विषय	पूर्णाङ्क	परीक्षा प्रणाली
अन्तर्वार्ता	३०	मौखिक

द्रष्टव्य :

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

२. प्रथम र द्वितीय पत्रको 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 बापत अङ्क दिइने छैन र अङ्क कट्टा पनि गरिने छैन ।

४. वस्तुगत बहुवैकल्पिक हुने परीक्षामा परीक्षार्थीले उत्तर लेख्दा अंग्रेजी ठूलो अक्षर (Capital letter) A,B,C,D मा लेख्नुपर्नेछ । सानो अक्षर (Small letter) a,b,c,d लेखेको वा अन्य कुनै सङ्केत गरेको भए सबै उत्तरपुस्तिका रद्द हुनेछ ।

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

६. परीक्षामा सोधिने प्रश्नसंख्या, अङ्क र अङ्कभार यथासम्भव सम्बन्धित पत्र /विषयमा दिइए अनुसार हुनेछ ।

७. विषयगत प्रश्न हुने पत्रका हकमा प्रत्येक खण्डका लागि छुट्टाछुट्टै उत्तरपुस्तिकाहरू हुनेछन् । परीक्षार्थीले प्रत्येक खण्डका प्रश्नहरूको उत्तर सोही खण्डको उत्तरपुस्तिकामा लेख्नुपर्ने छ ।

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 पाठ्क्रममा परेको सम्झनु पर्दछ ।

९. प्रथम चरणको परीक्षाबाट छनौट भएका उम्मेदवारलाई मात्र द्वितीय चरणको परीक्षामा सम्मिलित गराइनेछ ।

१०. **पाठ्यक्रम स्वीकृत मिति :– २०८२/०६/०९**

नेपाल इन्जिनियरिङ्ग परिषद्

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प्रथम पत्र (Paper I, Part I): Technical Subject

Section A - 34 Marks

1. Computer Fundamentals [4 x 1 Mark = 4 Marks]

1.1 Computers, kinds of computers in respect of size and function and generation of computers
1.2 Components and architecture of computers, connecting the components
1.3 Getting started: orientation to personal computers, system unit and starting
1.4 Input devices: keyboard, mouse, other input devices
1.5 Processing: CPU, memory
1.6 Storages devices: overview of storage devices, Floppy Disk Drive, Hard Drive, Universal Serial Bus (USB) Devices and other storage devices
1.7 Output devices: monitors, printers, modems, soundboards
1.8 DOS survival guide: using command prompt, creating and using AUTOEXEC.BAT and CONFIG.SYS
1.9 Windows survival guide: Windows Desktop, Program Manager, Desktop, File Manager
1.10 Application software: using application software
1.11 Windows explorer, e-mails, internet, intranet, extranets, Ethernet, HTTP
1.12 Computer viruses and antivirus

2. Operating Systems [6 x 1 Mark = 6 Marks]

2.1 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
2.2 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
2.3 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
2.4 Process Scheduling: Concept of Process Scheduling: FCFS, SPN, SRT, Round Robin, Multi-level feedback
2.5 Deadlock: Definition, Detection, Avoidance, Prevention and Recovery examples, Livelock, Two phase locking, Starvation
2.6 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
2.7 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
2.8 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

2.9 Distributed System: Characteristics, Client Server System, Process Synchronization & Inter process Communication, Fault Tolerance, Distributed File System, Transaction Management

3. Data Structure and Algorithms [6 x 1 Mark = 6 Marks]

3.1 Fundamental of Data Structures, Abstract Data types
3.2 Lists, Linked Lists, Stacks
3.3 Queues, Priority Queue
3.4 Trees: Traversal, Implementations, Binary Trees, Binary Search Trees, Balanced Search Trees, AVL Trees
3.5 Indexing Methods. Hashing Trees, Suffix Trees
3.6 Worst-Case and Expected Time Complexity
3.7 Analysis of Simple Recursive and Non-Recursive Algorithms
3.8 Searching, Merging and Sorting.
3.9 Introductory Notions of algorithm design: Divide-and-Conquer, Dynamic Programming, Greedy Methods, Backtracking
3.10 Graph algorithms: Depth-first Search and Breadth-first Search, Shortest Path Problems, Minimum Spanning Trees, Directed Acyclic Graphs

4. Software Engineering [6 x 1 Mark = 6 Marks]

4.1 Software process: The software lifecycle models, risk-driven approaches
4.2 Software project management: Relationship to lifecycle, project planning, project control, project organization, risk management, cost models, configuration management, version control, quality assurance, metrics
4.3 Software requirements: Requirements analysis, requirements solicitation, analysis tools, requirements definition, requirements specification, static and dynamic specifications, requirements review, feasibility analysis
4.4 Software design: Design for reuse and with reuse, design for change, design notations, design evaluation and validation
4.5 Implementation: Programming standards and procedures, modularity, data abstraction, static analysis, unit testing, integration testing, regression testing, tools for testing, fault tolerance
4.6 Maintenance: The maintenance problem, the nature of maintenance, planning for maintenance
4.7 SE issues: Formal methods, tools and environments for software engineering, role of programming paradigm, process maturity and Improvement, ISO standards, SEI-CMM, CASE tools

5. Database Management System and Design [6 x 1 Mark = 6 Marks]

5.1 Introduction, A Database Model, Relational Database Model, Integrity, RDBMS
5.2 SQL and Embedded SQL
5.3 Writing Basic SQL SELECT Statements
5.4 Restricting and Sorting data
5.5 Single Row Functions
5.6 Displaying Data from Multiple Tables
5.7 Aggregation Data Using Group Functions
5.8 Sub Queries, Manipulating Data and Creating and Managing Tables
5.9 Creating Views and Controlling User Access
5.10 Using Set Operators, Date-time Function

5.11 Database Design: Logical Design, Conceptual Design, Mapping Conceptual to Logical, Pragmatic issues, Physical Design, Integrity and Correctness, Relational Algebra, Relational Calculus
5.12 Normalization: 1NF, 2NF, 3NF, BCNF, 4NF,5NF, DKNF
5.13 Architecture of DBMS: Client-server, Open Architectures, Transaction Processing, Multi-User & Concurrency, and Backup & Recovery Database.
5.14 Basic concept of major RDBMS products: Oracle, Sybase, DB2, SQL Server and other Databases

6. Programming Language [6 x 1 Mark = 6 Marks]

6.1 Overview of Programming Language: History, Programming Paradigms, the role of Language translates in the Programming Process
6.2 Fundamental Issues in Language Design
6.3 Virtual Machines, Code Generation, Loop Optimization
6.4 Concept of Procedural Programming, Structural Programming, Object-Oriented Programming
6.5 Concept of C programming, C++ Programming
6.6 Common Gateway Interface (CGI) application
6.7 Input to CGI: environment variables, accessing from input
6.8 Output from CGI: CGI and response headers
6.9 Forms and CGI: Sending data to the server using HTML tags
6.10 Executing external program and CGI program
6.11 Hypermedia documents: Creating dynamic pages using CGI, PHP
6.12 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

Section B - 36 Marks

7. Networking [6 x 1 Mark = 6 Marks]

7.1 Basic Network Theory: Network Definition, Network Models, Connectivity, Network Addressing
7.2 Network Connectivity: Data Package, Establishing Connection, Reliable Delivery, Network Connectivity, Noise Control, Building Codes, Connection Devices
7.3 Advanced Network Theory: OSI model, Ethernet, Network Resources, Token ring, FDDI, Wireless Networking
7.4 Common Network Protocols: Families of Protocols, NetBEUI, Bridge and Switches, The TCP/IP Protocol, Building TCP/IP Network, The TCP/IP Suite
7.5 TCP/IP Services: Dynamic Host Configuration Protocol, DNS Name Resolution, NetBIOS support, SNMP, TCP/IP Utilities, FTP
7.6 Network LAN Infrastructure: LAN Protocols on a Network, IP Routing, IP Routing Tables, Router Discovery Protocols, Data Movement in a Routed Network, Virtual LANs
7.7 Network WAN Infrastructure: WAN Environment, Wan Transmission Technologies, Wan Connectivity Devices, Voice Over Data Services
7.8 Remote Networking: Remote Networking, Remote Access protocols, VPN Technologies
7.9 Network Security: Introduction, Virus Protection, Local Security, Network Access, Internet Security, Firewall, IDS, IPS, Encryption

7.10 Disaster Recovery: Need for Disaster Recovery, Disaster Recovery plan, Data backup, Fault Tolerance
7.11 Advanced Data Storage Techniques: Enterprise Data Storage, Clustering, Network Attached Storage, Storage Area Networks
7.12 Network Troubleshooting: Using Systematic Approach to Troubleshooting.
7.13 Network Support Tools: Utilities, Network Baseline
7.14 Network Access Points, Common Network Component, Common Peripheral Ports

8. Computer Architecture and Organization [4 x 1 Mark = 4 Marks]

8.1 Evaluation of Computers, Design Methodology, Set Architecture, MIPS ISA, ALU Design
8.2 Data path Design: Single and Multiple Cycle Implementations, Pipelining, Memory Hierarchy, Input/output System: Bus and Role of Operating System
8.3 Architecture of high speed work station and personal processors and systems
8.4 Instruction set design for pipelined machines
8.5 Multiple processor architectures, highly parallel machines, systolic arrays
8.6 Neural networks, multitasking machines, real-time systems, interconnection of multiple processor systems
8.7 Architectures for specialized purposes, array processors, vector processors.
8.8 Virtual machines

9. Client Server Computing [4 x 1 Mark = 4 Marks]

9.1 Client server computing concepts: Building blocks, the state of client server architecture
9.2 SQL database services: fundamentals of database servers, functions, procedures, triggers and rules
9.3 SQL middleware basics: SQL API, Open SQL Gateway
9.4 Concept of Data Warehouses
9.5 Client server transaction processing: transaction concepts, transaction models, transaction
9.6 Processing monitors, transaction management standards
9.7 Caching and cache servers

10. Distributed Systems [2 x 1 Mark = 2 Marks]

10.1 Characteristics of distributed systems
10.2 Networked vs. centralized systems
10.3 Fundamental concepts and mechanisms
10.4 Client-server systems
10.5 Process synchronization and inter process communications
10.6 Principles of fault tolerance
10.7 Transaction processing techniques
10.8 Distributed file systems
10.9 Operating systems for distributed architectures

11. MIS and Web Engineering & E-Commerce [4 x 1 Mark = 4 Marks]

11.1 Information Systems
11.2 Information Systems and Decision Making
11.3 Database Design issues, Data Mining, Data Warehousing
11.4 Knowledge Management, The strategic use of Information Technology

11.5 Work Process Redesign (Reengineering) with Information Technology, Enterprise Resources Planning Systems, Information Systems Security, Information Privacy, and Global Information Technology issues
11.6 Software Supported Demonstrations including advanced Spreadsheet topics, Software Component Based Systems (CBSE)
11.7 Multimedia
11.8 Object-Oriented Programming with COMS & DECOMS
11.9 Group Decision Support Systems
11.10 Basics of Website Design

12. E-Commerce Technology [4 x 1 Mark = 4 Marks]

12.1 Introduction to E-Commerce
12.2 Electronic Commerce Strategies
12.3 Electronic Commerce Security Issues
12.4 Success Models of E-Governance
12.5 E-Business: b2b, b2c, b2e, c2c, g2g, g2c
12.6 Principles of Electronic Payment, Strategies & Systems
12.7 E-marketing, Reverse Engineering
12.8 E-Banking, EDI Methods, SWIFT
12.9 Encryption and Decryption Methods, XML, Layout Managers, Event Model

13. Concept of management, Project Management & Marketing and Related Legislations [4 x 1 Mark = 4 Marks]

13.1 Management**:** concept, scope, functions, principles, and its practices
13.2 Project Management: Definitions, the project life cycle, setting project objectives & goals, Network model: CPM & PERT, Gantt Chart, Project scheduling, Resource leveling, Systems of project control, Cost control, Preparation of operational budget, Introduction to budgetary control, planning of quality, time & cost dimensions, negotiating for Materials, Supplies & Services, project monitoring and evaluation, Bringing the project to a successful conclusion.
13.3 History of IT in Nepal
13.4 Current ICT Policy of Nepal
13.5 Electronic Transaction Act, 2063
13.6 Copyright Act, Cyber Security Byelaw-2077 (2020)

14. Artificial Intelligence [4 x 1 Mark = 4 Marks]

14.1 Search
14.2 Natural Language Processing
14.3 Game Playing
14.4 Machine Learning
14.5 Automated reasoning
14.6 Planning
14.7 Vision and Robotics

15. Emerging Technology and Electives [4 x 1 Mark = 4 Marks]

15.1 Modeling and simulation
15.2 Block chain Technology
15.3 High speed networks
15.4 Adaptive web technology
15.5 Distributed Object technology (ORB, DCOM)

15.6 Speech signal processing
15.7 Embedded systems
15.8 Image processing
15.9 Multimedia
15.10 Expert system
15.11 GIS/ Remote sensing/ GPS

प्रथम पत्र (Paper I, Part II): General Subject
Section C - 30 Marks

1. General Awareness and Contemporary Issues [7 x 1 Mark = 7 Marks]

1.1 Contribution of major natural resources on the economic development of Nepal: Water resources, minerals, forest and bio-diversity
1.2 Basic knowledge on the geographical diversity, climatic conditions, and livelihood & lifestyle of people
1.3 Major development aspects of current periodic plan of Nepal
1.4 United Nations Sustainable Development Goals (UNSDGs) and Nepal's initiatives
1.5 The constitution of Nepal (from I to 5 and schedules)
1.6 Governance and government of Nepal (federal, provincial and local)
1.7 Major events and current affairs of national and international importance

2. Institutional Knowledge and Associated Laws [8 x 1 Mark = 8 Marks]

2.1 Nepal Engineering Council Establishment, goals, objectives, organizational structure, functions, current situation
2.2 Nepal Engineering Council Act, 2055
2.3 Nepal Engineering Council Rules, 2057
2.4 Nepal Engineering Council Personnel Administration Regulations, 2078
2.5 Nepal Engineering Council Financial Administration Regulations, 2073
2.6 The Prevention of Corruption Act, 2059 (Chapter 2 Offenses and Punishment)
2.7 Good Governance (Management and Operation) Act, 2064
2.8 Right to Information Act, 2064 Chapter 2, 4, 5

3. General Reasoning Test (15 ×1 Mark = 15 Marks)

3.1 **Logical Reasoning (5×1 Mark = 5 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

3.2 **Numerical Reasoning (5 ×1 Mark = 5 Marks)**
Arithmetic Series, Analogy, Classification, Arithmetical Reasoning, Fraction. Percentage, Ratio, Average, Profit & Loss, Time & Work, Date & Calendar, Data Sufficiency, Data Interpretation & Data Verification

3.3 **Spatial Reasoning (5×1 Mark = 5 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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द्वितीय पत्र (Paper II): Technical Subject

Section – A (50 Marks)

[2 x 5 Marks = 10, 4 x 10 Marks = 40]

1. Computer Fundamentals

1.1 Computers, kinds of computers in respect of size and function and generation of computers
1.2 Components and architecture of computers, connecting the components
1.3 Getting started: orientation to personal computers, system unit and starting
1.4 Input devices: keyboard, mouse, other input devices
1.5 Processing: CPU, memory
1.6 Storages devices: overview of storage devices, Floppy Disk Drive, Hard Drive, Universal Serial Bus (USB) Devices and other storage devices
1.7 Output devices: monitors, printers, modems, soundboards
1.8 DOS survival guide: using command prompt, creating and using AUTOEXEC.BAT and CONFIG.SYS
1.9 Windows survival guide: Windows Desktop, Program Manager, Desktop, File Manager
1.10 Application software: using application software
1.11 Windows explorer, e-mails, internet, intranet, extranets, Ethernet, HTTP
1.12 Computer viruses and antivirus

2. Operating Systems

2.1 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
2.2 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
2.3 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
2.4 Process Scheduling: Concept of Process Scheduling: FCFS, SPN, SRT, Round Robin, Multi-level feedback
2.5 Deadlock: Definition, Detection, Avoidance, Prevention and Recovery examples, Livelock, Two phase locking, Starvation
2.6 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
2.7 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
2.8 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

2.9 Distributed System: Characteristics, Client Server System, Process Synchronization & Inter process Communication, Fault Tolerance, Distributed File System, Transaction Management

3. Data Structure and Algorithms

3.1 Fundamental of Data Structures, Abstract Data types
3.2 Lists, Linked Lists, Stacks
3.3 Queues, Priority Queue
3.4 Trees: Traversal, Implementations, Binary Trees, Binary Search Trees, Balanced Search Trees, AVL Trees
3.5 Indexing Methods. Hashing Trees, Suffix Trees
3.6 Worst-Case and Expected Time Complexity
3.7 Analysis of Simple Recursive and Non-Recursive Algorithms
3.8 Searching, Merging and Sorting.
3.9 Introductory Notions of algorithm design: Divide-and-Conquer, Dynamic Programming, Greedy Methods, Backtracking
3.10 Graph algorithms: Depth-first Search and Breadth-first Search, Shortest Path Problems, Minimum Spanning Trees, Directed Acyclic Graphs

4. System Analysis and Design

4.1 Defining the System, System Owner, System User, System Designers and System builders, System Analysts, Variations on System Analyst title, System life Cycle
4.2 Joint Application Development (JAD): JAD definition, JAD purpose, JAD Philosophy, JAD Scope
4.3 Involved in a JAD: Sponsor, Business Users, System Analyst
4.4 Roles of JAD Group Member: Project Leader, Record Keeper, Time Keeper
4.5 System Design Environment: Development Process, Management Process, System Structure, Basic Component of Computer based Information System, Personal/ Centralized/Distribution System
4.6 Concept formations: Introduction, Finding the Problem, Evaluating the Proposal, Technical Feasibility, Operational Feasibility, Economic Feasibility
4.7 Requirements analysis: Representing System Analysis Model, Requirement Model, Design Model
4.8 Development Process: Design Method
4.9 Entity Relationship Diagram (E-R Diagram): Notations, Entities: Strong Entities, Weak Entities, Attributes: Simple and Composite, Single Valued and Multiple Valued, Null and Derived Attribute
4.10 Relationship Sets: Degree of Relationship and Cardinality Relationship, Specialization, Generalization, Aggregation
4.11 Data Flow Diagrams: Introductions, Data flow Diagram, Symbol, Files or data store, External entities, Data flows
4.12 Describing System by Data Flow Diagram: Context diagram, Top level DFD, Expansion Level DFD, Conversions of Data
4.13 Object Modeling: Object -Oriented Concept, Object Structure, Object Feature, Class and Object
4.14 Representation: Association and Composition, Inheritance, Multiple Inheritances
4.15 Modeling: Use Case Diagram, State Diagram, Event Flow Diagram
4.16 Documentation: Automatic and Manual System
4.17 Software Development Lifecycle (SDLC)

5. Database Management System and Design

5.1 Introduction, A Database Model, Relational Database Model, Integrity, RDBMS
5.2 SQL and Embedded SQL
5.3 Writing Basic SQL SELECT Statements
5.4 Restricting and Sorting data
5.5 Single Row Functions
5.6 Displaying Data from Multiple Tables
5.7 Aggregation Data Using Group Functions
5.8 Sub Queries, Manipulating Data and Creating and Managing Tables
5.9 Creating Views and Controlling User Access
5.10 Using Set Operators, Date-time Function
5.11 Database Design: Logical Design, Conceptual Design, Mapping Conceptual to Logical, Pragmatic issues, Physical Design, Integrity and Correctness, Relational Algebra, Relational Calculus
5.12 Normalization: 1NF, 2NF, 3NF, BCNF, 4NF,5NF, DKNF
5.13 Architecture of DBMS: Client-server, Open Architectures, Transaction Processing, Multi-User & Concurrency, and Backup & Recovery Database.
5.14 Basic concept of major RDBMS products: Oracle, Sybase, DB2, SQL Server and other Databases

6. Programming Language

6.1 Overview of Programming Language: History, Programming Paradigms, the role of language translates in the Programming Process
6.2 Fundamental Issues in Language Design
6.3 Virtual Machines, Code Generation, Loop Optimization
6.4 Concept of Procedural Programming, Structural Programming, Object-Oriented Programming
6.5 Concept of C programming, C++ Programming
6.6 Common Gateway Interface (CGI) application
6.7 Input to CGI: environment variables, accessing from input
6.8 Output from CGI: CGI and response headers
6.9 Forms and CGI: Sending data to the server using HTML tags
6.10 Executing external program and CGI program
6.11 Hypermedia documents: Creating dynamic pages using CGI, PHP
6.12 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

Section - B (50 Marks)
[2 x 5 Marks = 10, 4 x 10 Marks = 40]

7. Networking

7.1 Basic Network Theory: Network Definition, Network Models, Connectivity, network Addressing
7.2 Network Connectivity: Data Package, Establishing Connection, Reliable Delivery, Network Connectivity, Noise Control, Building Codes, Connection Devices
7.3 Advanced Network Theory: OSI model, Ethernet, Network Resources, Token ring, FDDI, Wireless Networking
7.4 Common Network Protocols: Families of Protocols, NetBEUI, Bridge and Switches, The TCP/IP Protocol, Building TCP/IP Network, The TCP/IP Suite

7.5 TCP/IP Services: Dynamic Host Configuration Protocol, DNS Name Resolution, NetBIOS support, SNMP, TCP/IP Utilities, FTP
7.6 Network LAN Infrastructure: LAN Protocols on a Network, IP Routing, IP Routing Tables, Router Discovery Protocols, Data Movement in a Routed Network, Virtual LANs
7.7 Network WAN Infrastructure: WAN Environment, Wan Transmission Technologies, Wan Connectivity Devices, Voice Over Data Services
7.8 Remote Networking: Remote Networking, Remote Access protocols, VPN Technologies.
7.9 Network Security: Introduction, Virus Protection, Local Security, Network Access, Internet Security, Firewall, IDS, IPS, Encryption
7.10 Disaster Recovery: Need for Disaster Recovery, Disaster Recovery plan, Data backup, Fault Tolerance
7.11 Advanced Data Storage Techniques: Enterprise Data Storage, Clustering, Network Attached Storage, Storage Area Networks
7.12 Network Troubleshooting: Using Systematic Approach to Troubleshooting.
7.13 Network Support Tools: Utilities, Network Baseline
7.14 Network Access Points, Common Network Component, Common Peripheral Ports

8. Computer Architecture and Organization

8.1 Evaluation of Computers, Design Methodology, Set Architecture, MIPS ISA, ALU Design
8.2 Data path Design: Single and Multiple Cycle Implementations, Pipelining, Memory Hierarchy, Input/output System: Bus and Role of Operating System
8.3 Architecture of high speed work station and personal processors and systems
8.4 Instruction set design for pipelined machines
8.5 Multiple processor architectures, highly parallel machines, systolic arrays
8.6 Neural networks, multitasking machines, real-time systems, interconnection of multiple processor systems
8.7 Architectures for specialized purposes, array processors, vector processors.
8.8 Virtual machines

9. Client Server Computing

9.1 Client server computing concepts: Building blocks, the state of client server architecture
9.2 SQL database services: fundamentals of database servers, functions, procedures, triggers and rules
9.3 SQL middleware basics: SQL API, Open SQL Gateway
9.4 Concept of Data Warehouses
9.5 Client server transaction processing: transaction concepts, transaction models, transaction
9.6 Processing monitors, transaction management standards
9.7 Caching and cache servers

10. Distributed Systems

10.1 Characteristics of distributed systems
10.2 Networked vs. centralized systems
10.3 Fundamental concepts and mechanisms
10.4 Client-server systems
10.5 Process synchronization and inter process communications

10.6 Principles of fault tolerance
10.7 Transaction processing techniques
10.8 Distributed file systems
10.9 Operating systems for distributed architectures

11 MIS and Web Engineering

11.1 Information Systems
11.2 Information Systems and Decision Making
11.3 Database Design issues, Data Mining, Data Warehousing
11.4 Knowledge Management, The strategic use of Information Technology
11.5 Work Process Redesign (Reengineering) with Information Technology, Enterprise Resources Planning Systems, Information Systems Security, Information Privacy, and Global Information Technology issues
11.6 Software Supported Demonstrations including advanced Spreadsheet topics, Software Component Based Systems (CBSE)
11.7 Multimedia
11.8 Object-Oriented Programming with COMS & DECOMS
11.9 Group Decision Support Systems
11.10 Basics of Website Design

12 E-Commerce Technology

12.1 Introduction to E-Commerce
12.2 Electronic Commerce Strategies
12.3 Electronic Commerce Security Issues
12.4 Success Models of E-Governance
12.5 E-Business: b2b, b2c, b2e, c2c, g2g, g2c
12.6 Principles of Electronic Payment, Strategies & Systems
12.7 E-marketing, Reverse Engineering
12.8 E-Banking, EDI Methods, SWIFT
12.9 Encryption and Decryption Methods, XML, Layout Managers, Event Model

13 Concept of management, Project Management & Marketing and Related Legislations

13.1 Management: concept, scope, functions, principles, and its practices
13.2 Project Management: Definitions, the project life cycle, setting project objectives & goals, Network model: CPM & PERT, Gantt Chart, Project scheduling, Resource leveling, Systems of project control, Cost control, Preparation of operational budget, Introduction to budgetary control, planning of quality, time & cost dimensions, negotiating for Materials, Supplies & Services, project monitoring and
13.3 evaluation, Bringing the project to a successful conclusion.
13.4 History of IT in Nepal
13.5 Current ICT Policy of Nepal
13.6 Electronic Transaction Act, 2063
13.6 Copyright Act, Cyber Security Byelaw-2077 (2020)

14 Artificial Intelligence

14.1 Search
14.2 Natural Language Processing
14.3 Game Playing
14.4 Machine Learning

14.5 Automated reasoning
14.6 Planning
14.7 Vision and Robotics

15 Emerging Technology

15.1 Modeling and simulation
15.2 Block chain Technology
15.3 High speed networks
15.4 Adaptive web technology
15.5 Distributed Object technology (ORB, DCOM)
15.6 Speech signal processing
15.7 Embedded systems
15.8 Image processing
15.9 Multimedia system
15.10 Expert system
15.11 GIS/ Remote sensing/ GPS
15.12 Cloud Computing
15.13 Big data