

सामाजिक सुरक्षा कोष
विविध सेवा, कम्प्युटर इन्जिनियरिङ समूह, छैटौ तह, सूचना प्रविधि अधिकृत पदको खुला र आन्तरिक
प्रतियोगितात्मक परीक्षाको पाठ्यक्रम
द्वितीय पत्र: सेवा सम्बन्धी
सामान्य प्राविधिक विषय: ५० अंक

वस्तुगत प्रश्नहरू

यस खण्डबाट देहाय बमोजिमको संख्यामा वस्तुगत बहुवैकल्पिक प्रश्नहरू सोधिनेछन्।

Unit	1	2	3	4	5	6	7	8	9	10
No. of Questions	5	5	6	4	6	6	4	5	4	5

1. Computer Architecture

- 1.1. Basic Structures : sequential circuits, design procedure, state table and state diagram, Von Neumann / Harvard architecture, RISC/CISC architecture
- 1.2. Addressing Methods and Programs, representation of data, arithmetic operations, basic operational concepts, bus structures, instruction cycle and excitation cycle
- 1.3. Processing Unit: instruction formats, arithmetic and logical instruction
- 1.4. Addressing modes
- 1.5. Input Output Organization : I/O programming , memory mapped I/O, basic interrupt system, Direct Memory Access (DMA)
- 1.6. Arithmetic Operations
- 1.7. Memory Systems

2. Basic Electrical, Electronics and Digital Design

- 2.1. Basic Circuit Theory, AC circuit Fundamentals
- 2.2. Magnetic circuits and Transformers
- 2.3. Transient Analysis, Filters
- 2.4. Semiconductors, Diodes and Diode Circuits, Transistors
- 2.5. Transistor modeling, Biasing and Amplification
- 2.6. Small Signal amplifiers and frequency response
- 2.7. Large signal amplifiers, feedback amplifiers and Oscillators
- 2.8. Operational amplifiers
- 2.9. Digital and Analog Systems. Number Systems.
- 2.10. Logic Elements, Combinational and Sequential Logic Circuits
- 2.11. Arithmetic Circuits
- 2.12. Counters and Registers
- 2.13. IC logic families
- 2.14. Interfacing with Analog Devices
- 2.15. Memory Devices

3. Operating System

- 3.1. Processes and Threads: Symmetric Multiprocessing, Micro- kernels, Concurrency, Mutual Exclusion and Synchronization, Deadlock
- 3.2. Scheduling: Concept and algorithms
- 3.3. Memory Management
- 3.4. 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
- 3.5. Distributed Systems: Distributed Message passing, RPC, Client/Server

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Computing, Clusters

3.6. Security : Authentication and Access Authorization, System Flaws and Attacks, Trusted system

4. Computer Networks

4.1. Protocol stack, OSI and TCP/IP models

4.2. Link Layer: services, error detection and correction, multiple access protocols, LAN addressing and ARP (Address Resolution Protocol), Ethernet, CSMA/CD multiple access protocol, Hubs, Bridges, and Switches, Wireless LANs, PPP (Point to Point Protocol), Wide area protocols

4.3. Network Layer :services, datagram and virtual circuits, routing principles and algorithms, Internet Protocol (IP), IP addressing, IP transport, fragmentation and assembly, ICMP (Internet Control Message Protocol), routing on the internet, RIP (Routing Information Protocol), OSPF (Open Shortest Path First), router internals, IPv6

4.4. Transport Layer: principles, multiplexing and demultiplexing, UDP, TCP, flow control, principles of congestion control, TCP congestion control

4.5. Application Layer : Web and Web caching, FTP (File Transfer Protocol), Electronic mail, DNS (Domain Name Service), socket programming

5. Structured and Object Oriented Programming

5.1. Concept of Procedural Programming, Structural Programming, Object- Oriented Programming

5.2. Data types, Abstract Data Types (ADT)

5.3. Operators, variables and assignments

5.4. Control structures

5.5. Procedure/function

5.6. Class definitions, encapsulation, inheritance, object composition, polymorphism

5.7. Concept of C programming, C++ Programming

6. Software Engineering

6.1. Software process: The software lifecycle models, risk-driven approaches

6.2. Software project management: Relationship to lifecycle, project planning, project control, project organization, risk management, cost models, configuration management, version control, quality assurance, metrics

6.3. Software requirements: Requirements analysis, requirements solicitation, analysis tools, requirements definition, requirements specification, static and dynamic specifications, requirements review, feasibility analysis

6.4. Software design: Design for reuse and with reuse, design for change, design notations, design evaluation and validation

6.5. Implementation: Programming standards and procedures, modularity, data abstraction, static analysis, unit testing, integration testing, regression testing, tools for testing, fault tolerance

6.6. Maintenance: The maintenance problem, the nature of maintenance, planning for maintenance

6.7. SE issues: Formal methods, tools and environments for software engineering, role of programming paradigm, process maturity and Improvement, ISO standards, SEI-CMM, CASE tools

7. Database Management System

7.1. The relational model, ER model

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- 7.2. Structured Query Language (SQL)
 - 7.3. Functional dependency, normalization and relational database design,
 - 7.4. Transaction Management and Concurrency Control: Concurrent execution of the user programs, transactions, Concurrency control techniques
 - 7.5. Crash Recovery : types of failure, Recovery techniques
 - 7.6. Query Processing and Optimization
 - 7.7. Indexing : Hash based indexing, Tree based indexing
 - 7.8. Distributed Database Systems and Object oriented database system
 - 7.9. Data Mining and Data Warehousing
 - 7.10. Database Security
- 8. Data Structure and Algorithms**
- 8.1. General concepts : Abstract data Type, Time and space analysis of algorithms, Big oh and theta notations, Average, best and worst case analysis
 - 8.2. Linear data structures
 - 8.3. Trees: General and binary trees, Representations and traversals, Binary search trees, balancing trees, AVL trees, 2-3 trees, red-black trees, self- adjusting trees, Splay Trees
 - 8.4. Algorithm design techniques: Greedy methods, Priority queue search, Exhaustive search, Divide and conquer, Dynamic programming, Recursion
 - 8.5. Hashing
 - 8.6. Graphs and digraphs
 - 8.7. Sorting: Concept and algorithms
- 9. Artificial Intelligence**
- 9.1. Search: Uninformed search techniques- depth first search, breadth first search, depth limit search, and search strategy comparison; Informed search techniques- hill climbing, best first search, greedy search
 - 9.2. Learning: Supervised Learning; Unsupervised Learning; Semi-supervised Learning; Reinforcement Learning; Neural Networks; Support Vector Machine (SVM); Self Organizing Map (SOM); Genetic Algorithms; Clustering; Decision Trees.
 - 9.3. Automated reasoning: FOPL; Knowledge Representation Languages. Basic Concepts of Natural Language Processing (NLP)
- 10. Advanced Topics in IT**
- 10.1. Parallel and distributed computing
 - 10.2. High speed networks
 - 10.3. Software Architecture
 - 10.4. Cyber Security
 - 10.5. E-commerce
 - 10.6. Software Project Management
 - 10.7. Cloud Computing
 - 10.8. Big Data Analytics
 - 10.9. Internet of Things (IoT)
 - 10.10. Machine Learning

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सेवा सम्बन्धी (प्राविधिक विषय)
विषयगत प्रश्नहरू

Section A – 30 Marks

From this section, long answer questions, carrying 10 marks each, will be asked as per the following distribution.

Unit	1	2	3	4	5	6
No. of Questions	1		1		1	

1. Computer Architecture

- 1.1. Basic Structures : sequential circuits, design procedure, state table and state diagram, Von Neumann / Harvard architecture, RISC/CISC architecture
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4. Computer Networks

- 4.1. Protocol stack, OSI and TCP/IP models
- 4.2. Link Layer: services, error detection and correction, multiple access protocols, LAN addressing and ARP (Address Resolution Protocol), Ethernet, CSMA/CD multiple access protocol, Hubs, Bridges, and Switches, Wireless LANs, PPP (Point to Point Protocol), Wide area protocols
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- 6.7. SE issues: Formal methods, tools and environments for software engineering, role of programming paradigm, process maturity and Improvement, ISO standards, SEI-CMM, CASE tools

Section B - 20 Marks

From this section, long answer questions, carrying 10 marks each, will be asked as per the following distribution

Unit	7	8	9	10
No. of Questions	1		1	

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