Nepal Government
Ministry of Communication and Information Technology
National Information Technology Center (NITC)

Post: Computer Engineer
Class: III

Syllabus

1. **Computer Networks**
   1.1 Protocol stack, switching
   1.2 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
   1.3 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
   1.4 Transport Layer: principles, multiplexing and DE multiplexing, UDP, TCP, flow control, principles of congestion control, TCP congestion control
   1.5 Application Layer: Web and Web caching, FTP (File Transfer Protocol), Electronic mail, DNS (Domain Name Service), socket programming) Distributed system, Clusters

2. **Computer Architecture & organization and micro-processors**
   2.1 Basic Structures: sequential circuits, design procedure, state table and state diagram, von Neumann / Harvard architecture, RISC/CISC architecture
   2.2 Addressing Methods and Programs, representation of data, arithmetic operations, basic operational concepts, bus structures, instruction, cycle and excitation cycle.
   2.3 Processing Unit: instruction formats, arithmetic and logical instruction.
   2.4 addressing modes
   2.5 Input Output Organization: I/O programming, memory mapped I/O, basic interrupt system, DMA
   2.6 Arithmetic
   2.7 Memory Systems
   2.8 808X and Intel microprocessors: programming and interfacing

3. **Structured and object oriented programming**
   3.1 Data types, ADT
   3.2 Operators, variables and assignments, control structures
   3.3 Procedure/function
   3.4 Class definitions, encapsulation, inheritance, object composition, Polymorphism
   3.5 Pattern and framework

4. **Data structures**
   4.1 General concepts: Abstract data Type, Time and space analysis of algorithms, Big oh and theta notations, Average, best and worst case analysis
   4.2 Linear data structures
   4.3 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

4.4 Algorithm design techniques: Greedy methods, Priority queue search, Exhaustive search, Divide and conquer, Dynamic programming, Recursion

4.5 Hashing

4.6 Graphs and digraphs

4.7 Sorting

5. Software Engineering principles (System analysis & design)

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

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

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

5.4 Software design: Design for reuse, design for change, design notations, design evaluation and validation

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

5.6 Maintenance: The maintenance problem, the nature of maintenance, planning for maintenance

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

6. Database Management System

6.1 Introduction: The relational model, ER model, SQL, Functional dependency and relational database design, File structure

6.2 Transaction Management and Concurrency Control: Concurrent execution of the user programs, transactions, Concurrency control techniques

6.3 Crash Recovery: types of failure, Recovery techniques

6.4 Query Processing and Optimization

6.5 Indexing: Hash based indexing, Tree based indexing

6.6 Distributed Database Systems and Object oriented database system

6.7 Data Mining and Data Warehousing

6.8 Security Management System

7. Operating System

7.1 Processes and Threads: Symmetric Multiprocessing, Micro-kernels, Concurrency, Mutual Exclusion and Synchronization, Deadlock.

7.2 Scheduling

7.3 Memory Management


7.5 Distributed Systems: Distributed Message passing, RPC, Client/Server Computing, Clusters.

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

8. **Data Center**
   8.1 Data Center fundamentals
   8.2 Components of Data Center
   8.3 Emerging technologies in Data Center

9. **Emerging Technologies**
   9.1 Parallel and distributed computing
   9.2 High speed networks
   9.3 Adaptive web technology
   9.4 Software Architecture
   9.5 Distributed Object technology (ORB, DCOM)
   9.6 Cryptography and network security
   9.7 E-commerce
   9.8 Software project management
   9.9 Image processing
   9.10 Multimedia
   9.11 GIS/ Remote sensing/ GPS

**Note:**
- Medium of exam is Nepali or English or Both
- No Negative marks