Assistant Director (Systems)
Syllabus

Topic/Module

1. Module I: Operating Systems and Computer Networks

Operating Systems: Batch, microprogramming, time sharing, multiprocessor and real time systems, Process management, Process Control Block, Threading, multithreading, CPU Scheduling, Schedulers, Context switching, Pre-emptive and nonpreemptive scheduling, Scheduling algorithms–FCFS, SJF, Priority, RR, Multi-level and multilevel feedback queue, Race condition, Critical section problem, Deadlock–detection and prevention, Memory Management–Address bindings, logical and physical addresses, contiguous memory allocation–first fit, best fit, worst fit allocation, internal and external fragmentation, Paging and segmentation, Demand paging, Page replacement algorithms–FIFO, Optimal, LRU, Thrashing, File systems, Sequential and indexed file organization, Directory structures, Contiguous, linked and indexed allocations, Disk scheduling algorithms, I/Osystems, protection & security.

Computer Networks: ISO/OSI reference model, TCP/IP model, Description of layers, Transmission impairments, Media–Guided and unguided, Encoding techniques, Modulation, Error detection and correction, ARQ techniques, Multiplexing, FDM-TDM-WDM, wired LAN–Ethernet protocol, wireless LAN– IEEE802.11 architecture, flow control, error control, IPV4 header format, IPV4 addressing, IPV6 header format, routing algorithms, congestion control, Transport layer services, Service primitives, Addressing, Transport layer protocols–UDP–TCP–SCTP, Application layer services-WWW-URL–HTTP– FTP–Electronic mail–SMTP, POP and IMAP-TELNET–DNS, Network Management Devices–Repeater, Hub, Switch, Router, Gateway, Wireless access point.

2. Module II: Programming Languages

Programming in C: Data types, operators and expressions, type conversions, control statements, user defined functions, arrays, Pointers and dynamic memory management, structure and union, file operations.
Programming Language Concepts: Parameter passing, binding, scope, recursion, imperative, declarative, functional and logic languages.
Object-oriented programming fundamentals–Object modeling using Unified Modeling Language. Classes, objects, methods, constructor/destructor, operator overloading, method overloading, objects as parameters to methods, static members. Inheritance–Super class,

subclass, protected members, method overriding, abstract class, generic classes. Runtime environment– Byte code, virtual machine like JVM. Dynamic binding, garbage collection, exception handling. Threads–Multithreading, stopping and resuming threads, thread synchronization.

3. Module III: Data structure and algorithms

Data Structures–Abstract Data Types-Algorithms-Characteristics-
Performance Analysis of Algorithms-Asymptotic Notations-Best, Average and Worst Case Analysis

Linear Data Structures-Arrays-One Dimensional and Multi Dimensional Arrays
-Sparse Matrices, Linked List-Singly Linked List-Doubly Linked List-
Operations–Applications, Stacks and Queues-Operations and Applications-Linear Queue-
Circular Queue

Non Linear Data Structures-Trees-Terminology-Binary Trees-
Binary Search Trees (BST)-Tree Traversals-Inorder, Preorder, Post order-
Height, Depth, and Level-Operations, Graphs-Terminology-Representation of Graphs (Adjacency Matrix, Adjacency List)-Graph Traversals (Breadth First Search(BFS), Depth First Search(DFS)) Minimum Spanning Tree(Prim's Algorithm, Kruskal's Algorithm) Shortest Path Algorithm (Dijkstra's Algorithm)
Searching-Linear Search-Binary Search, Sorting-Bubble Sort-Selection Sort- Insertion Sort-Merge Sort-Quick Sort-Comparison of Sorting Algorithms

4. Module IV: Web Programming and DBMS Web Programming

Markup Language (HTML): Formatting and Fonts, Commenting Code, Anchors, Backgrounds, Images, Hyperlinks, Lists, Tables, Frames, HTML Forms. Cascading Style Sheet (CSS):The need for CSS, Basic syntax and structure, Inline Styles, Embedding Style Sheets, Linking External Style Sheets,
Backgrounds, Manipulating text, Margins and Padding, Positioning using CSS.
Client Side Scripting using Java Script: Core features, Data types and Variables, Operators-Expressions and statements, Functions, Objects, Array, String-Date and Math related Objects, Document Object Model, Event Handling, Form handling and validations.
Server Side Scripting using PHP: PHP Programming basics-Print/echo, Variables and constants, Strings and Arrays, Operators, Control structures and looping structures, Functions, Reading Data in Web Pages, Embedding PHP within HTML, Establishing connectivity with database

Database Systems

Types of data and DBMS, entity-relationship models. Relational algebra–Select, project operations. Types of join operations. SQL, views, triggers, data definition language, table operations.

Normalization–Functional dependency, Armstrong's axioms, closures. Normal forms –first, second, third, Boyce-Codd. Lossless join, dependency-preserving decomposition. Concurrency–Transaction model, concurrent transaction

Processing and recovery principles, logs, checkpoints, schedules (concurrent, serializable, recoverable, cascade-less), conflict serializability, two-phase

locking. No SQL databases–Key-value database, document database, graph database.

5. Module V : System Administration, Software Engineering, AI and ML

System Administration : LINUX system Administration-Linux architecture and components-Linux Commands, Shell Scripting, Linux Server administration, User and Group Management, Process Scheduling and Job Control, Network Commands, Basic Network Troubleshooting

Intrusion and Detection: Requirements of IDS-Host based Intrusion detection, Network based intrusion detection

Malicious Software: Virus structure–Antivirus approaches-Antivirus techniques–Worms-Worm Countermeasures-BOT–ROOTKIT Denial of

Service: Denial of Service Attacks-Source Address Spoofing-SYN Spoofing-Flooding Attacks-ICMP Flood-UDP Flood-TCPSYN Flood-Distributed Denial of Service Attacks Defenses against DoS Attacks Firewall Types.

Software Engineering: Software life cycle models, Project planning–LOC, COCOMO,PERT/CPM, Gantt Chart, SRS, Data flow diagrams, Testing–Black box and white box, Software reliability, Reliability metrics, ISO9000, SEICMM, CASE. Version control systems–basics of Git, repository management, branching and merging.

ML and AI: Machine Learning Basics, Types of ML algorithms-Supervised, UnSupervised and Reinforcement Learning, Performance measures – Precision, recall, confusion matrix, accuracy, F-measure, receiver operating characteristic curve, area under curve.

Artificial Intelligence–Heuristic functions, minimax algorithm, Alpha-Beta pruning, constraint satisfaction problems. Knowledge representation and inference in first order logic, propositional logic, forward chaining, backward chaining.