TAMIL NADU PUBLIC SERVICE COMMISSION

COMPUTER SCIENCE AND ENGINEERING

(DEGREE STANDARD)

CODE: 407

UNIT - I: C PROGRAMMING AND OOP

Data Types, Operators, Expressions, Type casting - Arrays – Structures, Unions - Enumeration Types – Bit fields - Storage Classes - Preprocessor directives - Functions, Recursion - Pointers to arrays, structures, unions and functions – Dynamic Memory Allocation – Files. Object Oriented Programming using C++ and Java: Classes – Objects - Methods – Constructors and Destructors – Scope – Data Encapsulation – Polymorphism - Overloading and Overriding –Inheritance – Types of Inheritance – Interfaces - Abstract Classes and Methods – Virtual Classes and Functions – Final Methods and Classes - Exception Handling - Assertions – Garbage Collection – Cloning – Reflections - Files. Streams – Formatted Input and Output – Collections – Generic Classes and Methods Multithreading – Object Concurrency – Serialization.

UNIT – II: DATA STRUCTURES AND ALGORITHMS

Arrays – Searching and Sorting - Lists – Singly and Doubly linked lists – Stack Operations and Applications - Queue Operations and Applications – Trees – Binary Trees – Binary Search Trees : Representation, Traversals, Operations and Applications – AVL Trees, Heaps – Priority Queues – Graph – Representation, Traversals and Applications – Topological Sort – Hashing – Growth of Functions – Asymptotic Notation, O, Ω, θ – Recurrence Equations – Algorithms Design Strategies – Divide and Conquer – Quicksort, Merge Sort, Binary Search – Dynamic Programming – Warshall and Floyd's algorithms – Greedy Strategy – Minimum Cost Spanning Tree – Shortest Path Algorithm – Branch and Bound – Backtracking - String Matching algorithms – Naïve, Knuth Morris Pratt algorithm– NP Problems – Vertex Cover, Hamiltonian Cycle – Travelling Salesperson Problem – Approximation algorithms.

UNIT – III: DIGITAL LOGIC AND COMPUTER ARCHITECTURE

Boolean Algebra and Logic Gates – Combinational Logic – Sequential logic – Functional Units of a Digital Computer - Arithmetic operations : Addition and Subtraction – Binary Multiplication – Binary Division – Floating Point Numbers – Addressing Modes - Instruction Set Architecture – RISC and CISC Architectures CPU Performance Metrics - Data path and Control – Hazards: Structural, Data and Control Hazards – Dynamic Scheduling – Speculation – ILP and Thread Level Parallelism – Memory Hierarchy – Cache Memories – Virtual Memory – Associative memories – Accessing I/O devices – Interrupts - Direct Memory Access – Multicore Architectures – OpenMP – MPI – Cache coherence policies – GPU architectures and programming.

UNIT – IV: OPERATING SYSTEMS AND SYSTEM SOFTWARES

Process Concepts – Process Scheduling, Context Switch – Operation on Processes - Threads - Types of threads, Multithreading. Uniprocessor and Multiprocessor scheduling, Real time scheduling – Inter process Communications: shared memory, message passing - Mutual exclusion, semaphores, monitors, reader-writer problem - Deadlock prevention, avoidance, detection, integrated deadlock strategy, Dining Philosopher's problem. Address binding, logical versus physical address space, dynamic loading and linking, shared libraries, overlays, swapping, contiguous memory allocation, paging, segmentation - Demand paging, page replacement, frame allocation, thrashing - I/O devices, Organization of I/O function, I/O buffering, Disk scheduling - File access and organization, File directories and sharing, Storage management - Linux Operating Systems features - Phases of Compilers - One and Two Pass Assemblers – Loaders, Linkers - Macroprocessors and Emulators.

UNIT – V: DATABASE MANAGEMENT SYSTEMS

Database Applications – Data Models – Database Architecture – Key issues and Challenges in Database Systems – ER Models – ER to Relational Mapping – Object Relational Mapping – Relational Model - Constraints – Keys – Dependencies – Relational Algebra – Normalization – First, Second, Third & Fourth Normal Forms – BCNF – Join Dependencies – SQL – Embedded & Dynamic SQL – Triggers and Views – Data Constraints – Database Security – Transaction Systems – ACID Properties – System & Media Recovery – Concurrency – Locking Protocols – Log Based Recovery – Two Phase Commit Protocol - Recovery – Deadlocks & Managing Deadlocks – Indexing & Hashing Techniques – Query Processing & Optimization – Sorting & Joins – RAID Levels – Database Tuning – Data Mining and Warehousing – NoSQL – Geographical Information Systems (GIS).

UNIT – VI: SOFTWARE ENGINEERING

Software life-cycle and process models – Agile Models – Extreme Processing – Adaptive Software Development, Scrum – Dynamic System Development Models - Process Assessment Models; Project management activities. Requirements elicitation and analysis; Functional and non-functional requirements; User and system requirements, Requirement validation and specification. Design principles; System Models-Context, Behavioural, Data and object models, Architectural design-system structuring, Control models; Structured and object-oriented design; User interface design; Verification and validation planning; Test plan creation and test case generation; Black-box and White-box testing techniques; Unit, integration, validation and system testing; Object-oriented testing; Software inspections. Software maintenance; Reengineering; Legacy systems; Software reuse. Roles and responsibilities in a software team, Project

Planning and Scheduling; Software measurement and estimation; Risk analysis and management; Quality management; Configuration management. Quality assurance and Process Improvement; ISO 9000, CMMI, TQM and Six Sigma; programming environments; Project management tools; Requirements analysis and design tools; Testing tools; Configuration management tools; CASE tools – Documentation Tools – Presentation Tools.

UNIT - VII: COMPUTER NETWORKS AND SECURITY

ISO/OSI Model, Application Layer Protocols: HTTP, FTP, Telnet, Email, DNS – Performance Metrics, Transport Layer Protocols: User Datagram Protocol (UDP), Transmission Control Protocol (TCP), Flow Control, Congestion Control – Network Layer Protocol: Internet Protocol, IPV4/IPV6 Packet Format, IP Addressing, Subnetting, Classless Inter Domain Routing (CIDR), BOOTP/DHCP, ICMP, Routing Principles, Distance Vector Routing, Routing Internet Protocol – Link State Routing Protocol, OSPF, BGP. Data Link Layer Protocol: Framing, Addressing, Error Detection/Correction – Multiple Access Protocols – Address Resolution Protocol (ARP) – Ethernet Basics, CSMA/CD, Frame Format, Switching, Types (datagram, virtual), Wireless LAN (802.11), Piconet, Bluetooth, Security: Modes of operation, Encryption Techniques, DES, Triple DES, AES, RSA, Diffie-Hellman Key exchange, Elliptic Curve Cryptography, Message Authentication codes, Hash functions, Digital Signatures, Kerberos, X.509, PGP, S/MIME, IP Security, Web Security, SSL, TLS, SET, System security, Attacks : DoS, DDoS, Ethical Hacking, Firewalls, Blockchain Technologies.

UNIT – VIII: EMBEDDED SYSTEMS

Embedded System design process, Embedded processors – ARM Processor – Architecture, ARM Instruction sets – Addressing Modes – Pipelining – Embedded C Programming – Looping Structures – Register Allocation – Function calls – Pointer aliasing – Structure arrangement – bit fields – unaligned data and endianness – inline functions and inline assembly – portability issues. Profiling and cycle counting – instruction scheduling – Register allocation – Conditional execution – looping constructs – bit manipulation – optimized primitives. Multiple tasks and processes – Context switching – Scheduling policies – Interprocess communication mechanisms – Exception and interrupt handling – Performance issues. Meeting real time constraints – Multi-state systems and function sequences – Embedded software development tools – Emulators and debuggers – Design methodologies – Internet of Things (IoT) - Sensors.

UNIT – IX: CLOUD COMPUTING AND VIRTUALIZATION

Cloud Components, Infrastructure, Architecture, Applications, Benefits, Limitations, Cloud Deployment Models, Cloud Technologies. Infrastructure as a Service (IaaS) – Storage as a Service – Compute as a Service –

Platform as a Service (PaaS) – Software as a Service (SaaS): CRM as a Service, Social Computing Services, Document Services. Taxonomy, Server Virtualization, Desktop Virtualization, Network Virtualization, Storage Virtualization, Hypervisor. Hardware and Infrastructure – Server, Clients, Network, Software Defined Networks (SDN). Accessing the Cloud-Web Applications, Web API, Web Browsers. Scalable data storage techniques – Big Data Analytics. Map reduce Framework – Hadoop, HDFS. Artificial Intelligence – Machine Learning: Supervised Learning, Unsupervised Learning, Reinforcement Learning – Deep Learning – Transfer Learning – Natural Language Processing (NLP) – Data Visualization.

UNIT – X: WEB TECHNOLOGY AND MOBILE COMPUTING

Internet and WWW Protocols, Client side Programming: HTML, CSS, JavaScript, XML, DTD, Schema, XSLT, server side Programming: Python, PHP, Web Servers: configuration, security, Core Java: I/O, Network Programming, RMI, JDBC, Swing, Advanced Java: JSP, Servlets, Beans, MVC. Web Frameworks: sessions, user management, legacy databases and applications, Web Application development. Web Services: SOAP, UDDI, WSDL, Smart Devices and Mobile Operating Systems. Data compression and decompression – Augmented Reality/Virtual Reality. Mobile Computing : GSM, EDGE, GPRS, IS-95, CDMA 2000 and WCDMA, Recent Mobile Technologies – Mobile Application Development – Digital Marketing – E-commerce.

Note : Medium of instruction is English only.