Draft syllabus for recruitment of Lecturer In **Information Science & Engineering** for Polytechnics through KPSC.

Information Science & Engineering

- **Data Structures :**

  Notion of abstract data types, arrays, structures, pointers, files, Stack, Queue, List, Set, String, Tree, Binary search tree, Heap, Graph; Tree and graph traversals, connected components, Spanning trees, shortest paths; Flashing, Sorting, Searching, performance analysis of sorting & searching techniques ,applications of data structures.

- **Logic Design and Computer Organization :**

  Logic functions, Minimization, Design and synthesis of Combinational and Sequential circuits; Number representation and Computer Arithmetic (fixed and floating point); Machine instructions and addressing modes, ALU and Data-path, hardwired and micro-programmed control, memory interface, I/O interface (Interrupt and DMA mode), Serial communication interface, Instruction pipelining, Cache main and secondary storage. Multicores, Multiprocessors, and Clusters, Pipelining, Instruction ï Level Parallelism.

3. **Operating Systems :**

   Windows Operating System , linux/Unix operating system (Commands and Shell scripts), Classical concepts (concurrency, synchronization, deadlock), Processes, threads and Inter-process communication, CPU scheduling, Memory management, File systems, I/O systems, protection and security.

- **DBMS :**

  Relational model (ER-model, relational algebra, tuple calculus), Database design (integrity constraints, normal forms), Query languages (SQL), File structures (sequential files, indexing), Transactions and concurrency control; Operational Data Stores (ODS), Extraction Transformation Loading (ETL), Data Warehouses. Design Issues, Guidelines for Data Warehouse Implementation, Data Warehouse Metadata Online Analytical Processing (OLAP**):** Characteristics of OLAP systems, multidimensional view and Data cube, Data Cube implementations, Data Cube operations.

5. **Computer networks :**

   ISO / OSI Model , Network Topologies, Data encoding and transmission, data link control, sliding window protocols, LAN architecture, LAN systems, Ethernet, Token ring, routing protocols, Packet switching, Network devices ï switches, gateways, bridges, routers, TCP / UDP, application layer protocols and systems (http, smtp, dns, ftp), network security.

6. OOPs Concepts:

Class Specification, Class Objects, Scope resolution operator, Access members, Defining member functions, Data hiding, Constructors, Destructors, Parameterized constructors, Static data members, Functions, Friend functions, Passing objects as arguments, Returning objects, Arrays of objects, Dynamic objects, Pointers to objects, Copy constructors, Generic functions and classes, Applications.

Operator overloading using friend functions such as +, - , pre-increment, post-increment, [ ] etc., overloading <<, >>.

Base Class, Inheritance and protected members, Protected base class inheritance, Inheriting multiple base classes.

Constructors, Destructors and Inheritance, Passing parameters to base class constructors, Granting access, Virtual base classes, Virtual function, Calling a Virtual function through a base class reference, Virtual attribute is inherited, Virtual functions are hierarchical, Pure virtual functions, Abstract classes, Using virtual functions, Early and late binding. Stream classes, Formatted I/O, I/O manipulators, fstream and the File classes, File operations, Exception handling.

7. Software Engineering:

Software Requirements: Functional and Non-functional requirements; User requirements; System requirements; Interface specification; The software requirements document.

Requirements Engineering Processes: System Models: types of Models Structured methods.

Project Management: Management activities; Project planning; Project scheduling; Risk management, Architectural Design

Rapid Software Development: Verification and Validation:

8. Analysis and Design of Algorithms:

Notion of Algorithm, Review of Asymptotic Notations, Mathematical Analysis of Non-Recursive and Recursive Algorithms Brute Force Approaches: Selection Sort and Bubble Sort, Sequential Search and Brute Force String Matching. Divide and Conquer: General Method, Defective Chess Board, Binary Search, Merge Sort, Quick Sort and its performance.

The General Method, Knapsack Problem, Job Sequencing with Deadlines, Minimum-Cost Spanning Trees: Primôs Algorithm, Kruskalôs Algorithm; Single Source Shortest Paths.

The General Method, Warshallôs Algorithm, Floydôs Algorithm for the All-Pairs Shortest Paths Problem, Single-Source Shortest Paths: General Weights, 0/1 Knapsack, The Travelling Salesperson problem.

Decrease-and-Conquer Approaches: Introduction, Insertion Sort, Depth First Search and Breadth First Search, Topological Sorting.

Backtracking: n - Queens problem

9. File Structures:

A Conceptual Toolkit; Fundamental File Operations: Physical Files and Logical Files, Opening Files, Closing Files, Reading and Writing, Seeking, Special Characters, The Unix Directory Structure, Physical devices and Logical Files, File-related Header Files, Field and Record Organization, Using Classes to Manipulate Buffers, Using Inheritance for Record Buffer Classes, Managing Fixed Length, Fixed Field Buffers.

Data Compression, Reclaiming Space in files, Internal Sorting and Binary Searching, Key sorting;

The invention of B-Tree, Statement of the problem, Indexing with Binary Search Trees; Multi-Level Indexing, B-Trees, Creating a B-Tree Indexed Sequential Access, Maintaining a Sequence Set, Adding a Simple Index to the Sequence Set.

Hashing**:** Hashing Algorithm, Hashing Functions and Record Distribution.

10. Information System:

Fundamentals of strategic advantages: Strategic IT, Competitive strategy concepts, The competitive advantage of IT, Strategic uses of IT, Building a customer-focused business, The value chain and strategic IS, Reengineering business processes.

Enterprise Business Systems : Cross-functional enterprise applications, Enterprise application integration, Transaction processing systems, Enterprise collaboration systems.

Functional Business Systems: Marketing systems, Manufacturing systems, Human resource systems, Accounting systems, Financial management systems.

Customer relationship management: What is CRM? The three phases of CRM, Benefits and challenges of CRM, Trends in CRM.

Enterprise resource planning: What is ERP? Benefits and challenges of ERP, Trends in ERP, Supply chain Management

Decision support systems (DSS), Management Information Systems, Online analytical processing, Using DSS, Executive information systems, Enterprise portals and decision support, Knowledge management systems, Business and Artificial Intelligence (AI), Security, Ethical and societal challenges of IT: Ethical responsibility of business professionals, Computer crime, Privacy issues, Other challenges, Health issues, Societal solutions.