DETAILED SYLLABUS FOR MCA FIRST YEAR SECOND SEMESTER

Course code	**CSE/MCA/T/121A**
Category	**Data Structures and Algorithms**
Course title	
Scheme and Credits	**L–T–P: 3; Credits: 3**
Semester	
Pre-requisites (if any)	

Syllabus

Introduction, elementary data structures and their applications. **[1L]**

Lists: ordered lists, representation of arrays, linked lists: singly, doubly and circular linked lists, stacks, queues, dequeues, multiples stacks and queues, generalized lists, Applications: polynomial arithmetic, infix, postfix and prefix arithmetic expression conversion and evaluations. **[8L]**

Trees: General and binary trees, traversals, threaded binary tree, Binary Search Trees, AVL trees, B-Tree: B+ tree. **[6L]**

Searching & Sorting: Linear Search, Hashing, Internal and External sort, Insertion sort, Bubble sort, Selection sort [**4L**]

Complexity Analysis: Complexity measures, Worst, Best and Average Case, Upper and Lower bounds, Order Notations. **[2L]**

Divide and Conquer Technique: Definition, Binary Search, Merge Sort, Quick Sort, Multiplication of Large Integers. **[4L]**

Greedy Algorithms: Definition, Minimum spanning tree, Dijkstra's Algorithm for the shortest path, Fractional Knapsack Problem, Scheduling problems **[6L]**

Dynamic Programming: Definition, Making change problem, 0-1 Knapsack Problem, Floyd's algorithm for shortest paths, Chained Matrix Multiplication **[6L]**

Introduction to NP-completeness **[3L]**
Space and Time Complexity, Classes of Problems, Easy and Hard Problems, Concept of Reduction, The classes P,NP, NP-hard and NP-complete, Examples of NP-complete problems.

Suggested Readings:

1. Aaron M. Tenenbaum, Yedidyah Langsam, Moshe J. Augenstein, "Data Structures in C", Pearson Education India
2. R.L. Kruse, B.P. Leary, C.L. Tondo, "Data structure and program design in C," PHI
3. Ellis Horowitz and Sartaj Sahni, "Fundamentals of Data structures," Galgotia publications.
4. T Cormen, C Leiserson, R Rivest, C. Stein, "Introduction to Algorithms," MIT Press
5. Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, "Fundamentals of Computer Algorithms,"University Press

Course code	**CSE/MCA/T/122A**
Category	**Advanced Programming (JAVA and Python)**
Course title	
Scheme and Credits	**L–T–P: 3; Credits: 3**
Semester	
Pre-requisites (if any)	

Syllabus

Part-A: Java

Introduction to Java: Properties of Java, JVM. **[1L]**

Object-Oriented Programming Concepts: **[6L]**

- Classes, Objects, Methods, Constructors etc.
- Inheritance, Ploymorphism
- Packages, interfaces
- Wrapper Classes

Exception handling **[2L]**

Concurrency-- Threads and Synchronization **[3L]**

File Handling **[2L]**

Graphical User Interfaces (GUIs). **[4L]**

- Standard GUI components (buttons, text fields, radio button, check box, list etc.)
- Event handling

Collection Classes **[2L]**

Part B- Python Programming

VARIABLES, OPERATORS AND CONDITIONALS ***2L***

Introduction to Python Programming – Python Interpreter and Interactive Mode– Variables and Identifiers – Arithmetic Operators – Values and Types – Statements- Operators – Boolean Values – Operator Precedence – Expression – Conditionals: If-Else Constructs

LOOPS AND FUNCTIONS ***2L***

Loop Structures/Iterative Statements – While Loop – For Loop – Break Statement – Function Call and Returning Values – Parameter Passing – Local and Global Scope – Recursive Functions.

INTRODUCTION TO DATA STRUCTURES ***4L***

List – Adding Items to a List – Finding and Updating an Item – Nested Lists – Cloning Lists – Looping Through a List – Sorting a List – List Concatenation – List Slices – List Methods – List Loop – Mutability – Aliasing – Tuples: Creation, Accessing, Updating, Deleting Elements in a Tuple, Tuple Assignment, Tuple as Return Value, Nested Tuples, Basic Tuple Operations – Sets, Dictionary operations, Built-in Dictionary Functions & Methods

STRINGS OPERATIONS: ***3L***

Introduction, Indexing, Traversing, Concatenating, Appending, Multiplying, Formatting, Slicing, Comparing, Iterating – Basic Built – In String Functions – Dictionary: Creating, Accessing, Adding

Items, Modifying, Deleting, Sorting, Looping, Nested Dictionaries Built – in Dictionary Function – Finding Key And Value in a Dictionary

PYTHON - MODULES ***2L***

FILE HANDLING, EXCEPTION HANDLING AND SYSTEM LEVEL COMMANDS ***2L***
Files: Introduction – File Path – Opening and Closing Files – Reading and Writing Files – File Position – Exception: Errors and Exceptions, Exception Handling, Multiple Exceptions - Scripts: modules to access OS internals

PYTHON OBJECT ORIENTED PROGRAMMING ***4L***
Creating a class, Instantiating objects, Accessing Attributes, Adding attributes to a class, Built-In Class Attributes, Defining methods in a class, Passing arguments to methods, Destroying Objects (Garbage Collection), Class Inheritance, Overriding Methods, Base Overloading Methods, Overloading Operators, Data Hiding

PYTHON REGULAR EXPRESSION and PYTHON FOR DATA ANALYSIS **3L**

Books:
1. Herbert Schildt, Java: The Complete Reference, Latest Edition
2. Bruce Eckel , Thinking in Java
2. Reema Thareja, Python Programming: Using Problem Solving Approach
3. Martin C. Brown, Python: The Complete Reference

Course code	**CSE/MCA/T/123A**
Category	**Computer Organization and Architecture**
Course title	
Scheme and Credits	**L–T–P: 3; Credits: 3**
Semester	
Pre-requisites (if any)	

Syllabus

1. Introduction to basic structures and operational concepts, Instruction formats, Instruction execution, sequencing, Addressing modes, Stacks, Queues, Subroutines [Example instruction set may be used: INTEL/ARM/MOTOROLA/others] **[7L]**

2. Control unit – Concepts, Fetching and storing word from/in main memory, Register transfers, Operations, execution of a complete instruction Hardwired control, Microprogrammed control, Concept of horizontal and vertical microprogramming, Nanoprogramming, Concepts of pipelining **[8L]**

3. Fixed point Arithmetic - Arithmetic and logical operations of signed numbers and their implementation, Concepts of floating point numbers and operations, Bit-slice processors and Emulation **[5L]**

4. Memory – Basic concepts, RAM, ROM – different types, Characteristics, ache memories, Performance (memory interleaving, hit rate etc.), Memory hierarchy - virtual memory – address translation, Secondary memories **[8L]**

5. Input/output organization: memory mapped, standard (isolated) and linear selection techniques of I/O addressing. Data transfer through programmed I/O, interrupt and DMA I/O processors. Data transfer

over synchronous and asynchronous buses; discussions on some standard interface buses. **[8L]**

6. Brief introduction to RISC processors and parallel processing techniques. **[4L]**

Suggested Readings:
1. Computer Organization – C. Hamacher, Z. Vranesik, S. Zaky, McGraw Hill
2. Computer Architecture and Organization – John P. Hayes, McGraw Hill

Course code	**CSE/MCA/T/124A**
Category	**Operating Systems**
Course title	
Scheme and Credits	**L–T–P: 3; Credits: 3**
Semester	
Pre-requisites (if any)	

Syllabus

1. Introduction to Operating Systems [**1L]**

2. Concept of batch-processing, multi-programming, time sharing, real time operations [**2L]**

3. Process Management: Concept of process, state diagram, process control block; scheduling of processes – criteria, types of scheduling, non-preemptive and preemptive scheduling algorithms like: FCFS, Shortest Job First/Next (SJF/N), Shortest Remaining Time Next (SRTN), Round Robin (RR), Highest Response ratio Next (HRN), Priority based scheduling, different Multilevel queue scheduling etc.; [**5L]**

4. Threads – concept, process vs thread, kernel and user threads, multithreading models [**2L]**

5. Inter-process Communication (IPC) – Shared memory, message, FIFO, concept of semaphore, critical region, monitor [**2L]**

6. Process Synchronization: concepts, race condition, critical section problem and its solutions; synchronization tools- semaphore, monitor etc., discussion of synchronization problems like producer-consumer, readers-writers, dining philosophers, sleeping-barber etc. Deadlock – conditions, resource allocation graph, prevention techniques, avoidance technique – Banker's algorithm and related algorithms. [**6L]**

7. Memory management: Address space and address translation; static partitioning, dynamic partitioning, different types of fragmentation, paging, segmentation, swapping, virtual memory, demand paging, page size, page table, page replacement algorithms – FIFO, LRU, Optimal page replacement, Variants of LRU, etc; thrashing, working set strategy **[6L]**

8. File Management: File and operations on it, file organization and access; file allocation; directory structures, file sharing, file protection [**4L]**

9. Device management: Magnetic disks, disk scheduling- criteria, algorithms – FCFS, SSTF, SCAN, C-SCAN, LOOK, etc, disk management – formatting, boot block, disk free space management techniques, concept of RAID etc. [**3L]**

10. Protection and Security: Concepts of domain, Access matrix and its implementation, access control, Security of systems- concepts, threats- Trojan horse, virus, worms etc, introduction to cryptography as security tool, user authentication **[5L]**

11. Case Studies **[4L]**

Suggested Readings:

1. Operating Systems Concepts – A. Silberschatz, P. Galvin and G. Gagne. Wiley India
2. Operating Systems Concepts - Gary Nutt, N. Chaki and S. Neogy, Pearson Education
3. Operating Systems – W. Stallings, Pearson Education
4. Operating Systems: A Concept-based Approach – D. M. Dhamdhere, Tata McGraw-Hill

Course code	**CSE/MCA/T/125A**
Category	**Database Management Systems**
Course title	
Scheme and Credits	**L–T–P: 3; Credits: 3**
Semester	
Pre-requisites (if any)	

Syllabus

Introduction: Advantages of DBMS, Various levels of Data Definition and abstraction, Data Independence **[2L]**

Concepts of Different Database Models, Functional Components of DBMS and Overall Structure of DBMS **[2L]**

Relational Model: Relation, Attribute, Key, Foreign Key and other Relational Constraints **[2L]**

Database Design: ER Diagram, Mapping and Participation Constraints, Weak Entity Set, Aggregation, Extended ER diagram, Design of Database Tables from ER/EER Diagram **[4L]**

Languages: Relation Algebra, Relational Calculus **[3L]**
Structured Query Language **[3L]**

Functional Dependency: Concepts of Functional Dependency, Normalization, Multivalued Dependency **[5L]**

Database Storage: Fixed/Variable Length Record, Ordered/Unordered file and Operations on them **[1L]**

Indexing: Primary/Clustering/Secondary/Multilevel Index, B/B+ Tree based Indexing, Hashing **[3L]**

Query Optimization: Search Strategies, Expression level Optimization, Join strategies **[2L]**

Database Security **[1L]**

Case Study: Introduction to Oracle Architecture, PL/SQL, Trigger **[3L]**

Transaction and Recovery: Concept of Transaction and its States, Log based Recovery, Checkpoint **[3L]**

Concurrency Control: Lock based Protocol, Time Stamp based Protocol, Recoverable Schedule etc. **[3L]**

Advanced Concepts: Object-oriented database concepts and other query languages **[3L]**

Suggested Readings:

1. Fundamentals of Database Systems by E. Navathe
2. Database System Concepts by Korth and Silberschatz
3. Commercial Application Development Using Oracle Developer - 2000 by I. Bayross