IPS Academy, Institute of Engineering & Science

(A UGC Autonomous Institute, Affiliated to RGPV, Bhopal)

Department of Computer Science & Engineering

Bachelor of Technology (B.Tech.)

Minor Certification in Computer Science & Engineering

(To be offered to students of other departments excluding CS&IT)

S.No.	Subject Code	Category	Semester	Subject Name	Contact Hours per week			Total Credits
					L	T	P	
1.			V	Data Structure and Algorithm	2	1	2	4
2.			VI	Object Oriented Programming and Methodology	2	1	2	4
3.			VII	Database Management System	2	1	2	4
4.			VIII	*Operating System	2	1	-	3
				Total	8	4	6	15

1 Hr Lecture	1 Hr Tutorial	2 Hr Practical
1 Credit	1 Credit	1 Credit

Note: *VIII semester subject (Operating System or any other course equivalent to OS) can also be done from MOOC courses (NPTEL etc.) with minimum credit 3.

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	Data Structure & Algorithm	**2L : 1T : 2P (5 hrs.)**	**4 credits**

Course Objective:

The objective of this course is to understand different types of data structures and algorithms used in program.

Course Contents: (46 hrs.)

Module 1: **(10 hrs.)**

Review of C programming language. Introduction to Data Structure: Concepts of Data and Information, Classification of Data structures, Abstract Data Types, Implementation aspects: Memory representation. Analysis of algorithm: Time Complexity and Space Complexity, Data structures operations and its cost estimation, Basic of Asymptotic notation. Introduction to linear data structures- Arrays, String, representation & Operations, Linked List: Representation of linked list in memory, different implementation of linked list. Circular linked list, doubly linked list, etc. Application of linked list: polynomial manipulation using linked list, etc.

Module 2: **(10 hrs.)**

Stacks: Stacks as ADT, Different implementation of stack, multiple stacks. Application of Stack: Conversion of infix to postfix notation using stack, evaluation of postfix expression, Recursion. Queues: Queues as ADT, Different implementation of queue, Circular queue, Concept of Dqueue and Priority Queue, Queue simulation, Application of queues.

Module 3: **(10 hrs.)**

Tree: Definitions - Height, depth, order, degree etc. Binary Search Tree - Operations, Traversal, Search, AVL Tree, Heap, Applications and comparison of various types of tree; Introduction to forest, multi-way Tree, B tree, B+ tree, B* tree and red-black tree.

Module 4: **(08 hrs.)**

Graphs: Introduction, Classification of graph: Directed and Undirected graphs, etc, Representation, Graph Traversal: Depth First Search (DFS), Breadth First Search (BFS), Graph algorithm: Minimum Spanning Tree (MST)- Kruskal, Prim's algorithms. Dijkstra's shortest path algorithm; Comparison between different graph algorithms. Application of graphs.

Module 5: **(08 hrs.)**

Sorting: Introduction, Classification of sorting method, Sort methods like: Bubble Sort, Quick sort. Selection sort, Heap sort, Insertion sort, Shell sort, Merge sort and Radix sort; comparison of various sorting techniques. Searching: Basic Search Techniques: Sequential search, Binary search, Comparison of search methods. Case Study: Application of various data structures in operating system, DBMS etc.

Course Outcome:

1. Understand basic data structures such as arrays, linked lists, stacks and queues
2. Introduce the concept of data structures through ADT including List, Stack, Queues.
3. Understand the basic operations of trees and its types.
4. Understand the basic concept of graph and its operations.
5. Demonstrate and implement searching sorting algorithms.

List of Text / Reference Books:

1. Ellis Horowitz, Sartaj Sahni, "Fundamentals of Data Structures" Computer Science Press.
2. Mark Allen Weiss "Algorithms, Data Structures, and Problem Solving with C++" , Pearson Education (US) 1996
3. R. G. Dromey "How to Solve it by Computer", 2nd Impression by, PHI
4. AM Tanenbaum, Y Langsam& MJ Augustein, "Data structure using C and C++", 2nd Ed., 2006 , Prentice Hall India.
5. Robert Kruse, Bruse Leung, "Data structures & Program Design in C", 2nd Ed., 1997, Pearson Education.
6. Aho, Hopcroft, Ullman, "Data Structures and Algorithms", Pearson Education.
7. Richard, GilbergBehrouz, Forouzan ,"Data structure – A Pseudocode Approach with C", 2nd Ed., Thomson press.

List of Experiments:

Write a program:

1. To perform insertion and deletion operations on array.
2. To perform multiplication operation on matrix
3. To calculate factorial of number using recursion.
4. To demonstrate static implementation of stack.
5. To demonstrate dynamic implementation of stack.
6. To demonstrate static implementation of Linear queue.
7. To demonstrate dynamic implementation of Linear queue.
8. To implement circular queue.
9. To implement single linked list.
10. To implement doubly linked list.
11. To implement binary search tree.
12. To perform BFS and DFS operations on graph.
13. To perform binary search operation.
14. To perform sorting operation using bubble sort.
15. To perform sorting operation using insertion sort.

	Object Oriented Programming & Methodology	2L : 1T : 2P (5 hrs.)	Credits:04

Course Objective:

The course is designed to provide complete knowledge of Object Oriented Programming through and to enhance the programming skills of the students by giving practical assignments to be done in labs. Its main objective is to teach the basic concepts and techniques which form the object oriented programming paradigm.

Module 1: **(08 hrs.)**

Introduction to Object Oriented Programming, Comparison with Procedural Programming, features of Object oriented paradigm, merits and demerits of OO methodology; Introduction to Java Development Kit (JDK) & Java virtual machine (JVM); Linker & Loader; Data Encapsulation: Concept of Classes & Objects; State, Behavior & Identity of an object.

Module 2: **(08 hrs.)**

Data Abstraction and Message Passing: Methods, Calling of constructors, Decision making constructs, Control loops, Keywords: this, static; Access modifiers, Arrays within a class, String Class.

Module 3: **(10 hrs.)**

Relationship between classes: Generalization- Inheritance, Types of Inheritance, Ambiguity in multiple inheritances, Concept of interfaces; Specialization- Association, Aggregation and Composition; Static and Dynamic Binding: Polymorphism, Method Overriding & Overloading; Keywords: super, abstract, final.

Module 4: **(08 hrs.)**

Concept of Packages, Need of package; Basic idea of exception handling, stack based execution and exception propagation, Exception types: Exception Handling Try, Catch, Finally, Throw statement, Assertions.

Module 5: **(08 hrs.)**

Overview of Simple threads, Basic idea of Multithreaded Programming, Thread synchronization: Locks, synchronized methods, synchronized block, thread scheduling, Producer-consumer relationship, Daemon thread, Case Study: Chabot implementation etc.

Course Outcome:

1. Understand object oriented programming concepts, core JAVA and apply them in solving Problems.
2. Develop skill in data abstraction and message passing
3. Understand fundamentals of relationship amongst objects
4. Learn about the need of exception and errors
5. Develop ability to write a computer program to solve specified problems

List of Text Books / Reference Books:

1. G. Booch, “Object Oriented Analysis & Design”, Pearson.
2. Barbara Liskov, Program Development in Java, Addison-Wesley, 2001
3. James Martin, “Principles of Object Oriented Analysis and Design”, Prentice Hall/PTR.

4. Peter Coad and Edward Yourdon, "Object Oriented Design", Prentice Hall/PTR.
5. Herbert Schildt, "Java 2: The Complete Reference", 7th Edition, McGraw-Hill

List of Experiments:

1. A gardener plants a daisy flower and observes that on the first day the flower has 1 petal, on the second day the flower has 2 petals, on the third day it has 3 petals, on fourth day it has 5 petals, on fifth day it has 8 petals. Write a program to calculate how many petals will be there on the daisy flower on ninth day?
2. The Marks obtained by the class of 10 students are 45,50,66,32,80,77,59,63,71,85 respectively. Write a program for following
   - Arrange and print the marks in descending order
   - Calculate the average marks of the class
   - Find out whether any student got 95 marks(if yes print –"Student exist" and if no print – "Student doesn't exist")
3. WAP for the following calculating
   - Sum of square of given even numbers from 1 to 20
   - Sum of square of given odd numbers from 21 to 40
4. In the school while prayer assembly the 12 std boys and girls heights(in feet) are : Boys – 5.3, 5.6, 6.3, 5.9, 5.11
   Girls – 5.1, 5.9, 5.0, 5.5, 5.6
   Write a program for finding:
   - Tallest height in boys
   - Tallest height in girl
   - Tallest height in the class
   - Is there any student having height above 6.2 feet (o/p True or False)
   - How many boys have height between 5.5 and 5.9 feet
5. Create an abstract class Account. Inherit this class into two classes as CurrentAccount and SavingAccount. Identify the below attributes & methods and place them in suitable classes so as achieve best outcomes:
   - Attributes: Name_of_customer, Address, MobileNo, type_of_account, balanceAmt, etc.
   - Methods: withdrawal, deposit, displayInfo, viewBalance, calculateInterest (saving 6% & current 1%).
6. Write a program which does following on a given String. Count the number of occurrence of a particular character. (e.g. "assassinations" here 's' had come 5 times)
7. Write a program that takes a string (e.g. "apple is a fruit"). Obtain a substring from this string but starting from a second occurrence of a particular character (suppose. 'a') then output should be ("a fruit").
8. WAP to check weather a given string is a substring of other string. (e.g. "drinking" and other string is "packages drinking water" so here first string a substring of second hence the result must be TRUE).
9. Write a java program showing the concept of keywords this in java.
10. Write a java program showing the concept of constructor in java.
11. Write a java program showing the concept of Inheritance, super keyword & Interfaces in java.
12. Write a java program showing the concept of file handling in java.
13. Write a java program showing the concept of multithreading in java.
14. Write a java program showing the concept of exception handling in java.

	Database Management System	2L: 1T: 2P (5 hrs.)	4 credits

Course Objective:

The main objective of this course is to understand fundamental of database management system.

Course Contents: (45 hrs.)

Module 1: (06 hrs.)

DBMS Concepts and architecture Introduction, Database approach v/s Traditional file accessing approach, Advantages, of database systems, Data models, Schemas and instances, Data independence, Data Base Language and interfaces, Overall Database Structure, Functions of DBA and designer, ER data model: Entitles and attributes, Entity types, Defining the E-R diagram, Concept of Generalization, Aggregation and Specialization. transforming ER diagram into the tables. Various other data models object- o r i e n t e d data Model, Network data model, and Relational data model, Comparison between the three types of models.

Module 2: (08hrs.)

Relational Data models: Domains, Tuples, Attributes, Relations, Characteristics of relations, Keys, Key attributes of relation, Relational database, Schemas, Integrity constraints. Referential integrity, Relational Query languages: SQL-DDL, DML, integrity con straints, Complex queries, various joins, Relational algebra and relational calculus, Relational algebra operations like select, Project, Join, Division, outer union. Types of relational calculus i.e. Tuple oriented and domain oriented relational calculus and its operations.

Module 3: (14 hrs.)

Data Base Design: Introduction to normalization, Normal forms, Functional dependency, Decomposition, Dependency preservation and lossless join, problems with null valued and dangling tuples, multivalued dependencies. Query O p t i m i z a t i o n : Introduction, steps o f optimization, various algorithms to implement select, project and join operations of relational algebra, optimization methods: heuristic based, cost estimation based.

Module 4: **(09 hrs.)**

Transaction Processing Concepts: -Transaction s ystem , Testing of Serializability, Serializability of schedules, conflict & view serializable schedule, recoverability, Recovery from transaction failures. Log based recovery. Checkpoints deadlock handling. Concurrency

Control Techniques: Concurrency Control, locking Techniques for concurrency control, time stamping protocols for concurrency control, validation based protocol, multiple granularity. Multi version schemes, Recovery with concurrent transaction.

Module 5: **(08 hrs.)**

Study of Relational Database Management Systems through Oracle/PL SQL

QL/MySQL: Architecture, physical files, memory structures, background process. Concept of table spaces, segments, extents and block. Dedicated server, multi threaded server. SQL queries, Data extraction from single, multiple tables equi- join, non equi-join, self - join, outer join. Usage of like, any, all, exists, in Special operators. Cursor management: nested and parameterized cursors, Oracle exception handling mechanism. Stored procedures, in, out, in out type parameters, usage of parameters in procedures. User defined functions their limitations. Triggers, mutating errors, instead of triggers.

Course Outcomes:

1. Describe basic concepts of DBMS and Explain ER model.
2. Solve queries using Relational Algebra, Relational Calculus and SQL.
3. Explain database schema and discuss the Query optimization methods.
4. Describe transaction processing, concurrency control and recovery technique.
5. Analyze the Various DBMS software like Oracle, SQL/PL SQL etc.

List of Text / Reference Books:

1. Date C J, “An Introduction to Database System”, Pearson Educations, 8th Edition,2003.
2. Korth, Silbertz,Sudarshan, “Fundamental of Database System”, McGraw Hill,5th Edition,2006.
3. Peter Rob, “ Data Base System:Design Implementation & Management”, Cengage Learninig 4th Edition,2000.
4. Elmasri, Navathe, “Fundamentals of Database Systems”, Pearson Educations,7th Edition 2017.
5 . Atul Kahate ,“ Introduction to Database Management System”, Pearson Educations,2004.
6. Oracle 9i Database Administration Fundamental-I, Volume I, Oracle Press, TMH.
7. Paneerselvam,”DataBase Management System”, PHI Learning,3rd Edition,2018.
8. J. D. Ullman, “Principles of Database and Knowledge – Base Systems”, Computer Science Press,2nd Edition 1988.
9. Serge Abiteboul, Richard Hull, Victor Vianu,“Foundations of Databases”, Addison-Wesley,1995.

List of Experiments

1. Introduction to Oracle and SQL
2. Write the queries for Data Definition language (DDL)
3. Write the queries for Data manipulation language (DML)
4. Use of various types of Integrity Constraints
5. Write the queries for Data Control language (DCL)
6. Use of SELECT command with different clauses.
7. Write SQL queries using logical operation (AND, OR, NOT)
8. Write SQL queries for aggregate functions (Max, Min, Sum, Avg, and Count)
9. Write SQL queries for group by and having
10. Write SQL queries for sub queries and nested queries
11. Write an SQL query to implement JOINS
12. Write SQL queries to create views
13. Write program by the use of PL/SQL
14. Design and implementation of any Data base system (like Banking, University etc).

	Operating System	2L: 1T: 0P (3 hrs.)	3 credits

Course Objective:

This Course provides a comprehensive introduction of Operating System, Process Management, Memory Management, File Management and I/O management.

Course Contents: (40 hrs.)

Module 1: **(06 hrs.)**

Introduction to Operating Systems: Function, Evolution, Different Types, Desirable Characteristics and features of an O/S, Operating Systems Services: Types of Services, Different ways of providing these Services – Utility Programs, System Calls, Operating System Structure, and Spooling & Buffering.

Module 2: **(11 hrs.)**

CPU Scheduling : Process Concept, Scheduling Concepts, Types of Schedulers, Scheduling Criteria, Process State Diagram, Scheduling Algorithms, Operation on Process, Algorithms Evaluation, System calls for Process Management; Multiple Processor Scheduling; Concept of Threads. Concurrent Processes : Real and Virtual Concurrency, Mutual Exclusion, Synchronization, Inter- Process Communication, Critical Section Problem, Solution to Critical Section Problem : Semaphores – Binary and Counting Semaphores, WAIT & SIGNAL Operations and their implementation. Deadlocks: Deadlock Problems, Characterization, Prevention, Avoidance, Recovery.

Module 3: **(11 hrs.)**

Memory Management: Different Memory Management Techniques – Partitioning, Swapping, Segmentation, Paging, Paged Segmentation, Comparison of these techniques, Techniques for supporting the execution of large programs: Overlay, Dynamic Linking and Loading, Virtual Memory – Concept, Implementation by Demand Paging etc., Page replacement algorithms.

Module 4: **(06 hrs.)**

File Systems: File Concept, User's and System Programmer's view of File System, Disk Organization, Tape Organization, Different Modules of a File System, Disk Space Allocation Methods – Contiguous, Linked and Indexed. Directory Structures, File Protection, System Calls for File Management, Disk Scheduling Algorithms.

Module 5: **(06 hrs.)**

Introduction to Network, Distributed and Multiprocessor Operating Systems. Case Studies: Unix/Linux, WINDOWS and other Contemporary Operating Systems.

Course Outcomes:

1. State the core concepts of operating system, evolution and types of operating system.
2. Illustrate various input output concepts, interprocess communication and deadlock
3. Illustrate process scheduling and memory management techniques.
4. Describe the concept of file and disk management.
5. State the core concepts of network, distributed and multiprocessor operating system.

List of Text / Reference Books:

1. Avi Silberschatz, Peter Galvin, Greg Gagne, "Operating System Concepts Essentials", Wiley Asia Student Edition, 10th Edition, 2018.
2. William Stallings, "Operating Systems: Internals and Design Principles", Prentice Hallof India, 5th Edition, 2005.
3. Charles Crowley, "Operating System: A Design-oriented Approach", Irwin Publishing, 1st Edition.
4. Gary J. Nutt, "Operating Systems: A Modern Perspective", Addison-Wesley, 2nd Edition.
5. Maurice Bach, "Design of the Unix Operating Systems", Prentice-Hall of India, 8th Edition.
6. Daniel P. Bovet, Marco Cesati, "Understanding the Linux Kernel", O'Reillyand Associates, 3rd Edition.
7. Andrew S. Tanenbaum, "Modern Operating Systems", Prentice Hall, 3rd Edition,2007.
8. Bovet & Cesati, "Understanding the Linux Kernel", O'Reily, 3rd Edition.