Manipal University Jaipur

Department of Data Science & Engineering

B. Tech. Computer Science & Engineering (Data Science)

Syllabus

2nd Year – III Semester

2024 Onwards

Subject Code:	DSE2101	Subject Name:	Data Structures & Algorithms
Semester:	III	Branch Name:	CSE (Data Science)
Subject Type:	Core		

Pre-requisites (if any): Problem solving using C

DSE2101: Data Structures & Algorithms [3 1 0 4]

Course Outcomes

CO1: Understand the performance analysis of algorithms with their applications.

CO2: Illustrate basic concept of data structure operations such as traversing, insertion, deletion, searching and sorting.

CO3: Describe arrays, linked lists, stacks, queues, trees, and graphs are their representation in memory.

CO4: Perform various operations on different data structures and to solve real time problems.

CO5: Analyse and compare various searching and sorting algorithms, and assess the trade-offs involved in the design choices to develop employability skills.

Course Contents

Introduction: Algorithm Specification; **Performance Analysis:** Time and Space Complexity, Asymptotic Notation; **C Concepts:** Pointers, Functions, Arrays, Passing Arrays to Functions through Pointers, Dynamic Memory Allocation, Bubble Sort, Insertion Sort, Selection Sort, Structures, Arrays of Structures, Passing Structures to Functions; **List:** ADT, Array and its Types, Implementation, Operations, Linked List and its Types, Implementation and Operations; **Stack:** ADT, Implementations using Array and Linked List, Operations and its Applications; **Queue:** ADT, Implementations using Array and Linked List, Operations and its Applications; **Tree:** Terminologies, Different Types, Representation of Binary Tree using Array and Linked Structure, Binary Search Tree, Different Operations (Recursive and Non-Recursive), Heap, Heap Sort, Priority Queue, AVL Trees, B-Tree; **Graph:** Introduction, Representation, Operations and Applications; **Searching Techniques And Hashing.**

Textbooks:

1. Aaron M. Tenenbaum, Yedidyah Langsam, Moshe J. Augenstein, "Data Structures using C", Pearson Education, 2013.

References Books:

1. Ellis Horowitz, Sartaj Sahni and Susan Anderson-Freed, "Fundamentals of Data Structures in C", University Press (India) Pvt. Ltd., 2014.
2. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, "Data Structures and Algorithms", Pearson Education, 2012.

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3. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to algorithms", PHI, Fourth Edition, 2022.
4. Seymour Lipschutz, "Data Structures with C (Schaum's Outline Series)", McGraw Hill Education Private Limited, 2011.
5. Mark Allen Weiss, "Data structures and Algorithm Analysis in C", Pearson, Second edition, 2014.

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Subject Code:	DSE2102	Subject Name:	Computer System Architecture
Semester:	III	Branch Name:	CSE (Data Science)
Subject Type:	Core		

Pre-requisites (if any):

DSE2102: Computer System Architecture [3 1 0 4]

Course Outcomes

CO1: Recall the number systems (binary, decimal, hexadecimal) and perform direct conversions between them.

CO2: Understand the differences between Harvard Architecture and Von Neumann Architecture.

CO3: Apply Boolean algebra concepts to minimize Boolean functions using Karnaugh Maps.

CO4: Analyse the operation and performance of various peripheral devices and input-output interfaces.

CO5: Evaluate the effectiveness of different memory management techniques, including memory hierarchy and virtual memory, in optimizing system performance.

Course Contents

Introduction to Digital System: Number System, Direct conversion between bases, Negative numbers. Boolean Algebra, Minimization of Boolean Functions: K-Map (Up to 4-variable). **Combinational Logic Circuits:** Design Procedure, Adders, Subtractors, Decoder, Encoder, Multiplexers, Demultiplexers. **Basic Computer Concepts:** Organization and Architecture, Harvard Architecture vs Von Neumann Architecture, Structure of Digital Computer System Components, Computer Registers, Types of Registers and their Functions, Bus Architecture, Types of Buses. **Data Representation and Micro Operations:** Register Transfer Language, Arithmetic Micro-Operations, Logic Micro-Operations, Shift Micro-Operations, Signed Operand Multiplication, Booth Multiplication. **Fixed Point Representation:** Integer Representation, Arithmetic Addition, Arithmetic Subtraction, Floating Point Representation, IEEE754 Standard Floating-Point Representation. **Central Processing Unit:** General Register Organization, Stack Organization, Instruction Codes, Instruction Set: Characteristics, Cycle, Formats, Types, Addressing Modes. **Input-Output Organization:** Peripheral Devices, Input Output Interface, Asynchronous Data Transfer, Modes of Transfer, Priority Interrupt, Direct Memory Access. **Memory Organization:** Basic concept of memory system, Memory Hierarchy, Main Memory, Auxiliary Memory, 2D & 2.5D Memory Organization, Associative Memory, Cache Memory, Virtual Memory.

Textbooks:

1. Morris Mano, "Computer System Organization" PHI.

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2. C. Hamacher, Z. Vranesic, S. Zaky, Computer Organization, Tata McGraw Hill.

References Books:

1. Hwang, Kai, Advanced Computer Architecture: Parallelism, Scalability, Programmability, TMH.
2. Hayes, J. P., MGH, Computer Architecture & Organization.
3. Ram, B., Computer Fundamentals: Architecture & Organization, New Age.
4. J. L. Hennessy, D. A. Patterson, Computer Architecture: A Quantitative Approach, Morgan Kaufmann Publishers.
5. M. W. Stallings, Computer Organization and Architecture –Designing for Performance, Pearson.

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Subject Code:	DSE2131	Subject Name:	Data Structures & Algorithms Lab
Semester:	III	Branch Name:	CSE (Data Science)
Subject Type:	Lab		

Pre-requisites (if any):

DSE2131: Data Structures & Algorithms Lab [0 0 2 1]

Course Outcomes

CO1: Recall and Understand the basic programming concepts of various data structures.

CO2: Describe arrays, linked lists, stacks, queues and trees with representation in memory and their operations.

CO3: Implement different data structures to solve real world problems.

CO4: Explain different data structures and algorithms work and their advantages and disadvantages

Course Contents

Implementation of array operations: insertion, deletion, linear search and binary search, matrix operation. **Implementation of singly, doubly and circular linked lists:** inserting, deleting, and inverting a linked list, Polynomial addition, subtraction and sparse matrix implementation by linked list. **Stacks and Queues:** adding, deleting elements. **Circular Queue:** Adding & deleting elements, conversion of infix to postfix and Evaluation of postfix expressions using stacks & queues, Implementation of stacks & queues using linked lists. **Recursive and non-recursive traversal of Trees:** Threaded binary tree traversal, BST and AVL tree implementation. **Implementation of sorting and searching algorithms:** bubble sort, Insertion sort, selection sort, quick sort, heap sort, merge sort, Hash table implementation.

Textbooks:

1. Forouzan, R. F. Gilberg, A Structured Programming Approach Using C, Cengage Learning.
2. S. Tannenbaum, J. Augenstein, Data Structures using C, Pearson India.

References Books:

1. E. Horowitz, S. Sahni, Fundamentals of Data Structures in C, Universities Press.
2. Cormen, T. H., Leiserson, C. E., Rivest, R. L., Stein, C. Introduction to Algorithms, Fourth Edition. United Kingdom: MIT Press.

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Subject Code:	DSE2130	Subject Name:	Data Mining Lab
Semester:	III	Branch Name:	CSE (Data Science)
Subject Type:	Lab		

Pre-requisites (if any):

DSE2130: Data Mining Lab [0 0 2 1]

Course Outcomes

CO1: To implement data structure and different operations in data types like vectors, lists, matrices, arrays.

CO2: To implement and demonstrate through charts and graphs using for data analysis and PCA.

CO3: To implement and demonstrate time series, Precision, Recall, TP rate, FP rate and F-measure and Apriori algorithm.

CO4: To implement and demonstrate the classification and regression concepts.

CO5: To implement and demonstrate the performance and evaluation of different algorithms.

Course Contents

Explore the various Datasets, Perform data Preprocessing tasks and Demonstrate performing **Association Rule Mining on Datasets:** Attribute Selection, Handling Missing Values, Discretization, Eliminating Outliers. Market Basket analysis, Apriori Algorithm, FP Growth Algorithm. **Demonstrate performing Classification on Datasets:** Decision Tree, Naïve Bayesian Classifier, K- Nearest Neighbor Classifier, SVM. **Demonstrate performing Clustering of Datasets:** K-Means, Hierarchical Clustering, DBSCAN. Performance evaluation using Confusion matrix and related case studies.

Textbooks:

1. Pang-Ning Tan, Michael Steinbach, Vipin Kumar, Introduction to Data Mining, Pearson education.
2. Han, J., Pei, J., & Tong, H. *Data mining: Concepts and Techniques*. Morgan Kaufmann.

References Books:

1. P. Ponniah, Data Warehousing, Wiley India Pvt. Ltd.
2. Berson and S. J. Smith, Data Warehousing, Data Mining & OLAP, Tata McGraw – Hill.

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Subject Code:	DSE2120	Subject Name:	Object Oriented Programming
Semester:	III	Branch Name:	CSE (Data Science)
Subject Type:	Flexi Core 1		

Pre-requisites (if any): Basic Programming Concept

DSE2120: Object Oriented Programming [3 1 0 4]

Course Outcomes

CO1: Understand the principles of encapsulation and abstraction via objects and classes.

CO2: Understand the use of various polymorphic forms using classes and interfaces.

CO3: Learn the application of various forms of inheritance in real life programming problems.

CO4: Understand the advanced programming concepts such as exception handling and multithreading.

Course Contents

Introduction: Objects, Classes, Encapsulation, Polymorphism, Inheritance; **Java Basics:** Compilation and Execution of a Java program, Java Compiler and Interpreter, Data Types in Java; **Class Definition and Object Creation:** Instance-Fields/Attributes, Methods, Access Modifiers, Constructors, Object vs Class Variables; Role of static and final keywords in Java, Type Conversion and Promotion; **Polymorphic Forms:** Method Overloading, Objects as Parameters and return types; **Input-Output:** Reading Input and Output in Java; **Object Class in Java:** String form of an Object via toString() method, Object equality method; **Arrays and Strings in Java:** 1-D Arrays, 2-D and Multi-dimensional arrays, Variable Size array, Dynamic Arrays using Array Lists, Strings in Java via String, StringBuilder and StringTokenizer classes; **Inheritance in Java:** Extending classes, abstract classes, final classes, Method Overriding, Runtime Polymorphism, Inner Classes – static and non-static nested Classes, Local Classes; **Inheritance via Interfaces:** class vs interface, defining interfaces, implementing multiple inheritance; Comparator and Comparable interfaces, Iterators and List Iterators, Linked Lists; **Exception Handling:** Exceptions, Defining and Creating Exceptions, Use of Exceptions in Real Life Problems; **Package in Java:** Defining and Creating Packages, importing packages; **Garbage Collector:** Role, definition, explicit call; **Multithreading:** Thread class, Runnable interface, thread life cycle, synchronization, thread priority, creating and running threads.

Textbooks:

1. "Java : The Complete Reference", Herbert Schildt, 12th Edition, McGraw Hill, 2022, ISBN-10 : 9355323719, ISBN-13: 978-9355323712.

References Books:

1. "Programming with Java", E Balagurusamy, 6th Edition, McGraw Hill, 2019, ISBN-10: 9353162343, ISBN-13: 978-9353162344.

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2. "Object Oriented Programming Through Java", Vishwajeet Barbudhe, 1st Edition, 2020, ISBN-10: 1648690874, ISBN-13: 978-1648690877.

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