**Semester III**

| Course Code | Course Name | Teaching Scheme (Contact Hours) | | | Credits Assigned | | |
|---|---|---|---|---|---|---|---|
| | | Theory | Pract. | Tut | Theory | Pract/ tut | Total |
| NADPC31 | Probability and Graph Theory | 2 | - | | 2 | | 2 |
| NADPC32 | Data Structure | 3 | 2 | | 3 | 1 | 4 |
| NADPC33 | Database Management System | 3 | 2 | | 3 | 1 | 4 |
| NADPC34 | Foundation of Data Science | 1 | 2 | | | 2 | 2 |
| NADMM31 | Cryptography and System Security | 3 | 2 | | 3 | 1 | 4 |
| NADAE31 | Presentation & business communication | 2 | | | 2 | | 2 |
| NADEM31 | Finance for Engineering | $2 | - | | 2 | - | 2 |
| **Total** | | **17** | **08** | | **15** | **05** | **20** |

**Examination Scheme**

| Course Code | Course Name | Theory | | | | Term Work | Pract | Total |
|---|---|---|---|---|---|---|---|---|
| | | Internal Assessment | | End Sem Exam | Exam Duration (hrs.) | | | |
| | | MT | CA | | | | | |
| NADPC31 | Probability and Graph Theory | 20 | 20 | 60 | 2 | - | -- | 100 |
| NADPC32 | Data Structures | 20 | 20 | 60 | 2 | 25 | 25 | 150 |
| NADPC33 | Database Management System | 20 | 20 | 60 | 2 | 25 | 25 | 150 |
| NADPC34 | Foundation of Data Science | -- | -- | -- | -- | 25 | 50 | 75 |
| NADMM31 | Cryptography and System Security | 20 | 20 | 60 | 2 | 25 | 25 | 150 |
| NADAE31 | Presentation & business communication | -- | -- | -- | -- | 50 | -- | 50 |
| NADEM31 | Finance for Engineering | -- | -- | -- | -- | 50 | -- | 50 |
| **Total** | | **80** | **80** | **240** | **--** | **175** | **150** | **725** |

# COURSE NAME: DATA STRUCTURES

| Course Code | Course Name | Teaching Scheme (Teaching Hours) | | | Credits Assigned | | | |
|---|---|---|---|---|---|---|---|---|
| | | Theory | Practical | Tutorial | Theory | TW/PR | Tut | Total |
| NADPC32 | Data Structures (Theory) | 03 | --- | --- | 03 | --- | --- | 03 |
| NADPC32 | Data Structures (Lab) | --- | 02 | --- | --- | 01 | --- | 01 |

| Course Code | Course Name | Teaching Scheme (Teaching Hours) | | | Credits Assigned | | | |
|---|---|---|---|---|---|---|---|---|
| | | Theory | Practical | Tutorial | Theory | TW/PR | Tut | Total |
| NADPC32 | Data Structures (Theory) | 03 | --- | --- | 03 | --- | --- | 03 |

| Course Code | Course Name | Examination Scheme | | | | | |
|---|---|---|---|---|---|---|---|
| | | Theory | | | Term Work | Practical & Oral | Total |
| | | Internal Assessment | | End Sem Exam | | | |
| | | Mid-Term Test | Continuous Assessment | | | | |
| NADPC32 | Data Structures (Theory) | 20 | 20 | 60 | --- | --- | 100 |

| | |
|---|---|
| **Prerequisite: C Programming** | |
| **Course Objectives: The course aims:** | |
| 1 | To understand the need and significance of Data structures as a computer Professional. |
| 2 | To teach concept and implementation of linear and Nonlinear data structures. |
| 3 | To analyze various data structures and select the appropriate one to solve a specific real-world problem. |
| 4 | To introduce various techniques for representation of the data in the real world. |
| 5 | To teach various searching techniques. |
| **Course Outcomes:** Students will be | |
| 1 | Able to understand the fundamentals of Linear data structures and operations on them. |
| 2 | Be able to identify scenarios for usage of different data structures and implement them. |
| 3 | Able to understand the fundamentals of Non-Linear data (tree) structure and implement them. |
| 4 | Able to understand various types of tree and its application. |
| 5 | Be able to analyze and implement appropriate searching and sorting techniques for a given problem. |
| 6 | Able to demonstrate the ability to analyze, design, apply and use data structures to solve engineering problems and evaluate their solutions. |

| Course Code | Course Name | Teaching Scheme (Teaching Hours) | | | Credits Assigned | | | |
|---|---|---|---|---|---|---|---|---|
| | | Theory | Practical | Tutorial | Theory | Practical | Tut | Total |
| NADPC32 | Data Structures (Lab) | --- | 02 | --- | --- | 01 | --- | 01 |

| Course Code | Course Name | Examination Scheme | | | | | |
|---|---|---|---|---|---|---|---|
| | | Theory | | | Term Work | Practical & Oral | Total |
| | | Internal Assessment | | End Sem Exam | | | |
| | | Mid-Term Test | Continuous Assessment | | | | |
| NADPC32 | Data Structures (Lab) | --- | --- | --- | 25 | 25 | 50 |

| | |
|---|---|
| **Prerequisite: C Programming Language.** | |
| *Lab Objectives:* | |
| 1 | To implement basic data structures such as arrays, linked lists, stacks and queues |
| 2 | Solve problem involving different types of trees |
| 3 | To develop application using data structure algorithms |
| **Lab Outcomes:** | |
| 1 | Students will be able to implement linear data structures & be able to handle operations like insertion, deletion, searching and traversing on them. |
| 2 | Students will be able to implement nonlinear data structures & be able to handle operations like insertion, deletion, searching and traversing on them |
| 3 | Students will be able to choose appropriate data structure and apply it in various problems |
| 4 | Students will be able to select appropriate searching techniques for given problems. |

## Data Structures (Theory)

| Module | | Detailed Content | Hours |
|---|---|---|---|
| 1 | | **Introduction** | **2** |
| | 1.1 | Introduction to Data Structures, Concept of ADT, Types of Data Structures- Linear and Nonlinear, Operations on Data Structures. | |
| 2 | | **Stack and Queues** | **8** |
| | 2.1 | Introduction, ADT of Stack, Operations on Stack, Array Implementation of Stack, Applications of Stack-Well form-ness of Parenthesis, Infix to Postfix Conversion and Postfix Evaluation, Recursion. | |
| | 2.2 | Introduction, ADT of Queue, Operations on Queue, Array Implementation of Queue, Types of Queue-Circular Queue, Priority Queue, Introduction of Double Ended Queue, Applications of Queue. | |
| 3 | | **Linked List** | **10** |
| | 3.1 | Introduction, Representation of Linked List, Linked List v/s Array, Types of Linked List - Singly Linked List, Circular Linked List, Doubly Linked List, Operations on Singly Linked List and Doubly Linked List, Stack and Queue using Singly Linked List, Singly Linked List Application-Polynomial Representation and Addition. | |
| 4 | | **Trees** | **6** |
| | 4.1 | Introduction, Tree Terminologies, Binary Tree, Binary Tree Representation, Types of Binary Tree, Binary Tree Traversals, Binary Search Tree, Operations on Binary Search Tree, Applications of Binary Tree-Expression Tree, Huffman Encoding. | |
| 5 | | **Types of Tree** | **7** |
| | 5.1 | Search Trees-AVL Tree, Red Black Tree, B Tree, B+ Tree and n-ary tree | |
| | 5.2 | Introduction to Heaps, Heap representation using array, heap creation and deletion, Heap operations | |
| 6 | | **Sorting and searching Techniques** | **6** |
| | 6.1 | Linear Search, Binary Search, Tries, Hashing, Collision resolution Technique | |
| | 6.2 | Bubble Sort, Selection Sort, Insertion Sort, Merge Sort, Quick Sort, Heap Sort, Bucket Sort | |
| | | | **39** |

| **Textbooks:** | |
|---|---|
| 1 | Aaron M Tenenbaum, Yedidyah Langsam, Moshe J Augenstein, “Data Structures Using C”, Pearson Publication. |
| 2 | Reema Thareja, “Data Structures using C”, Oxford Press. |
| 3 | Richard F. Gilberg and Behrouz A. Forouzan, “Data Structures: A Pseudocode Approach With C”, 2nd Edition, CENGAGE Learning. |
| 4 | Jean Paul Tremblay, P. G. Sorenson, “Introduction to Data Structure and Its Applications”, McGraw-Hill Higher Education |
| 5 | Data Structures Using C, ISRD Group, 2nd Edition, Tata McGraw-Hill. |

**References:**


| | |
|---|---|
| 1 | Prof. P. S. Deshpande, Prof. O. G. Kakde, "C and Data Structures", DreamTech press. |
| 2 | E. Balagurusamy, "Data Structure Using C", Tata McGraw-Hill Education India. |
| 3 | Rajesh K Shukla, "Data Structures using C and C++", Wiley-India |
| 4 | GAV PAI, "Data Structures", Schaum's Outlines. |
| 5 | Robert Kruse, C. L. Tondo, Bruce Leung, "Data Structures and Program Design in C", Pearson Edition |


| **Access to software and virtual labs:** | |
|---|---|
| 1 | https://cse01-iiith.vlabs.ac.in/List%20of%20experiments.html |
| 2 | https://ds1-iiith.vlabs.ac.in/List%20of%20experiments.html |
| 3 | https://nptel.ac.in/courses/106/102/106102064/ 2 https://www.coursera.org/specializations/data-structures-algorithms 3 https://www.edx.org/course/data-structures-fundamentals |
| 4 | https://cse01-iiith.vlabs.ac.in/List%20of%20experiments.html |
| **Industry articles and case studies :** | |
| 1 | https://www.gyata.ai/data-structure/articles/ |
| 2 | https://www.geeksforgeeks.org/real-time-application-of-data-structures/ |

**Internal Assessment:**
Assessment consists of one Mid Term Test of 20 marks and Continuous Assessment of 20 marks. Mid Term test is to be conducted when approximately 50% syllabus is completed. Duration of the midterm test shall be one hour.

**Continuous Assessment:**
Continuous Assessment is of 20 marks. The rubrics for assessment will be considered based on approval by the subject teachers. The rubrics can be any 2 or max 4 of the following:

| Sr. No. | Rubrics | Marks |
|---|---|---|
| 1 | *Certificate course for 4 weeks or more: NPTEL/ Coursera/ Udemy/any MOOC | 10 marks |
| 2 | Content beyond syllabus presentation | 10 marks |
| 3 | Creating Proof of concept | 10 marks |
| 4 | Mini Project / Extra Experiments/ Virtual Lab / Competitive programming-based event / Group Discussion | 10 marks |
| 5 | Multiple Choice Questions (Quiz) | 5 marks |
| 6 | GATE Based Assignment/Tutorials etc. | 10 marks |

*For sr. no.1, the date of certification exam should be within the term and in case a student is unable to complete the certification, the grading has to be done accordingly.

| End Semester Theory Examination: | |
|---|---|
| 1 | Question paper will be of 60 marks |
| 2 | Question paper will have a total of five questions |
| 3 | All questions have equal weightage and carry 20 marks each |
| 4 | Any three questions out of five need to be solved. |

## Data Structures (Lab)

| **Suggested Experiments** Students are required to complete at least 10 experiments. | |
|---|---|
| **Sr. No.** | **Name of the Experiment** |
| 1 | Implement Stack and its operations with real life applications |
| 2 | Convert an Infix expression to Postfix expression using stack ADT. |
| 3 | Evaluate Postfix Expression using Stack ADT. |
| 4 | Implement Linear Queue using array. |
| 5 | Implement Circular Queue using array. |
| 6 | Implement Priority Queue ADT using array. |
| 7 | Implement Singly Linked List. |
| 8 | Implement Circular Linked List. |
| 9 | Implement Doubly Linked List. |
| 10 | Implement Stack / Linear Queue using Linked List. |
| 11 | Implement Binary Search Tree |
| 12 | Searching Techniques : Binary Search, Tries, Hashing |
| 13 | Sorting Techniques: Merge Sort, Quick Sort, Heap Sort, Bucket Sort |

**Note:** Suggested List of Experiments is indicative. However, flexibilities lie with individual course instructor to design and introduce new, innovative and challenging experiments, (limited to maximum 30% variation to the suggested list) from within the curriculum, so that, the fundamentals and applications can be explored to give greater clarity to the students and they can be motivated to think differently.

| Term Work: | |
|---|---|
| 1 | Term work should consist of 10 experiments. |

| | |
|---|---|
| 2 | The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work. |
| 3 | Total 25 Marks<br>(Experiments: 15-marks, Term work Assessment: 10-marks) |
| **Evaluation Exam** | |
| 1 | Practical Exam based on the entire syllabus |

Every student is accepted to implement real life application from 3 module.