**MANIPAL UNIVERSITY JAIPUR**School of Computing and IT

Department of Computer Science and Engineering  
Course Hand-out

Data Structures | CS 1331 | 1 Credit | 0 0 2 1

Session: July 19 – Nov 19 | Faculty: Dr. Prakash Ramani | Class: III Semester



1. **Introduction:** This course is offered by Computer Science and Engg. Dept., targeting students who wish to pursue development and research in industries or higher studies in field of Computer Science, IT and Communication Engineering. This course will form the base of computer science and engineering and hence this course is introduced at this level to make the students understand various ways of organizing data and storing it into memory and use the type depending upon the application.
2. **Course Outcomes:** At the end of the course, students will be able to
3. Explain basic concepts of various data structures
4. Describe how arrays, linked lists, stacks, queues, trees and graphs are represented in memory and their operations
5. Select and/or apply appropriate data structures to solve problems.
6. Implement various sorting and searching algorithms
7. **PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES**

**[PO.1] Engineering Knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems

**[PO.2] Problem Analysis**: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences

**[PO.3] Design/Development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations

**[PO.4] Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions

**[PO.5] Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations

**[PO.6] The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice

**[PO.7] Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development

**[PO.8] Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practices

**[PO.9] Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings

**[PO.10] Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions

**[PO.11] Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments

**[PO.12] Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

1. Will be able to design, develop and implement efficient software for a given real life problem.
2. Will be able to apply knowledge of AI, Machine Learning and Data Mining in analysing big data for extracting useful information from it and for performing predictive analysis.
3. Will be able to design, manage and secure wired/ wireless computer networks for transfer and sharing of information.
4. **Assessment Plan:**

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| **Criteria** | **Description** | **Maximum Marks** |
| Internal Assessment (Summative) | Continuous Assessments | 70 |
| Exam  (Summative) | Exam  (Small Project/Exam) | 30 |
|  | Total | 100 |
| Attendance  (Formative) | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |
| Make up Assignments  (Formative) | Students who misses a lab will have to report to the teacher about the absence. A makeup assignment on the topic taught on the day of absence will be given which has to be submitted within a week from the date of absence. No extensions will be given on this. The attendance for that particular day of absence will be marked blank, so that the student is not accounted for absence. These assignments are limited to a maximum of 2 throughout the entire semester. | |

1. **SYLLABUS**

Review of C and programs on Recursion, Stacks, Stacks, Queues, lists, Trees, Graphs, using C language.

1. **TEXT BOOKS**

T1. Aaron M. Tenenbaum, Yedidyah Langsam, Moshe J. Augenstein, “Data Structures using C”, Pearson Education, 2013.

1. **REFERENCE BOOKS**
2. Ellis Horowitz, Sartaj Sahni and Susan Anderson-Freed, “Fundamentals of Data Structures in C”, University Press (India) Pvt. Ltd., 2014.
3. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, “Data Structures and Algorithms”, Pearson Education, 2012
4. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, “ Introduction to algorithms”, PHI, Third Edition, 2009
5. Seymour Lipschutz, “Data Structures with C (Schaum's Outline Series)”, McGraw Hill Education Private Limited, 2011.
6. Mark Allen Weiss, “Data structures and Algorithm Analysis in C”, Pearson, Second edition, 2014.
7. **LAB PLAN**

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| Lec No | **Topics** | **Session Outcome** | **Mode of Delivery** | **Corresponding CO** | **Mode of Assessing the Outcome** |
|  | **Arrays** | Programs based on 1-D array operations | Lab | CS1331.1  CS1331.3 | Internal Evaluation  Home Assignments  External Evaluation |
|  |  | Programs based on 2-D array operations | Lab | CS1331.1  CS1331.3 | Internal Evaluation  Home Assignments  External Evaluation |
|  |  | Programs based on 2-D array operations with pointer notations | Lab | CS1331.1  CS1331.2 | Internal Evaluation  Home Assignments  External Evaluation |
|  | **Linked List** | Programs to implement singly linked-list list operations | Lab | CS1331.2  CS1331.3 | Internal Evaluation  Home Assignments  External Evaluation |
|  |  | Programs to implement Circular Linked list and Doubly-linked list operations | Lab | CS1331.1  CS1331.2 | Internal Evaluation  Home Assignments  External Evaluation |
|  | **Stacks** | Programs to implement stack and its operations | Lab | CS1331.2  CS1331.3 | Internal Evaluation  Home Assignments  External Evaluation |
|  |  | Programs based on implementation of stack | Lab | CS1331.1  CS1331.2 | Internal Evaluation  Home Assignments  External Evaluation |
|  | **Queue** | Programs based on implementation of queue and its operations | Lab | CS1331.2  CS1331.3 | Internal Evaluation  Home Assignments  External Evaluation |
|  | **Tree** | Programs to implement tree and its operations | Lab | CS1331.1  CS1331.2  CS1331.3 | Internal Evaluation  Home Assignments  External Evaluation |
|  |  | Programs based on implementation of trees | Lab | CS1331.3 | Internal Evaluation  Home Assignments  External Evaluation |
|  | **Graph** | Programs to implement graph and its operations | Lab | CS1331.1  CS1331.2 | Internal Evaluation  Home Assignments  External Evaluation |
|  |  | Programs based on implementation of graphs | Lab | CS1331.2  CS1331.3 | Internal Evaluation  Home Assignments  External Evaluation |
|  | **Sorting and Searching** | Programs to perform sorting using different sorting techniques over data | Lab | CS1331.2  CS1331.4 | Internal Evaluation  Home Assignments  External Evaluation |

**Course Articulation Matrix: (Mapping of COs with POs)**

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| **CO** | **STATEMENT** | CORRELATION WITH PROGRAM OUTCOMES | | | | | | | | | | | | CORRELATION WITH PROGRAM SPECIFIC OUTCOMES | | |
| PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
| CS 1303.1 | Explain basic concepts of various data structures | 3 | 2 |  |  |  |  |  |  |  |  |  | 2 | 3 |  |  |
| CS 1303.2 | Describe how arrays, linked lists, stacks, queues, trees and graphs are represented in memory and their operations |  | 1 | 2 |  |  |  |  |  |  |  |  | 2 | 2 |  | 2 |
| CS 1303.3 | Select and/or apply appropriate data structures to solve problems and assess the trade-offs involved in the design choices. |  | 1 | 2 |  |  |  |  |  |  |  |  | 2 | 3 |  | 2 |
| CS 1303.4 | Describe and analyze various sorting algorithms like bubble, selection ,insertion, merge sort, heap sort and quick sort |  | 1 | 2 |  |  |  |  |  |  |  |  | 2 | 3 |  | 1 |

1. **Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**