॥वसुधैव कुटुम्बकम्॥

SYMBIOSIS INSTITUTE OF TECHNOLOGY, NAGPUR

Symbiosis International (Deemed University)

(Established under section 3 of the UGC Act, 1956)

Re-accredited by NAAC with 'A++' Grade | Awarded Category – I by UGC

Founder: Prof. Dr. S. B. Mujumdar, M. Sc., Ph. D. (Awarded Padma Bhushan and Padma Shri by President of India)

Course Name: Data Structures Lab
Course Code: TE7959
Faculty: Engineering
Course Credit: 1
Course Level: 3
Sub-Committee (Specialization): Computer Science and Engineering
Learning Objectives:

The students will be able to:

1. To Implement and compare different searching and sorting techniques.
2. To Implement operations on different types of link list such as singly link list, circular link list and doubly link list.
3. To demonstrate create, insert and delete operations and traversal of binary search tree.
4. To Implement different graph algorithms and its applications.

Course Outcome (CO):

1. To implement the different searching and sorting techniques.
2. To implement linked list programs
3. To implement different types of tree data structures and tree traversing algorithms.
4. To implement the concepts of graph and traversing algorithms with its applications.
5. To able to implement some open-ended problems.

Program Outcome (PO):

1. Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.
2. Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.
3. 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.
4. 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.
5. 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.
6. 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.
7. Understand the impact of the professional engineering solutions in societal and environmental contexts and demonstrate the knowledge of, and need for sustainable development.
8. Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. Function effectively as an individual and as a member or leader indiverse teams and in multidisciplinary settings.
10. 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.
11. Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadcast context of technological change.
12. 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.

Program Specific Outcomes (PSO):

1. To apply the concepts of computer engineering and practical knowledge in analysis, design and development of computing systems and applications to multi-disciplinary problems.
2. To provide a concrete foundation to the students in the cutting edge areas of CSE and further help them in excelling in chosen areas of advanced computer science like Machine Learning, Algorithms, Data Science, Internet of Things, Computing and Data Security and Privacy.

Pre-Requisites: Knowledge of C/C, Basics of Data Structures

Books Recommended:

Book	Author	Publisher
A practical data structure and algorithm research on drawing and editing vector graphics	Information Computing and Telecommunications (YC-ICT)	NA
Data structure & Algorithm Analysis in C++	Weiss, Mark Allen	ISBN-032144146X, Addison Wesley,3rd Edition 2007.
Data structure using C	AM Tanenbaum, Y Langsam & MJ Augustein	ISBN 9788131702291 Pearson Prentice Hall India, 9th Edition 2009
Data structures & Program Design in C	Robert Kruse, C.L.Tondo, Bruce Leung	ISBN 9780132883665,Pearson, 4th Edition 2009.
Data Structures: A pseudo code approach with C, ISBN 9780534390808, 2nd Edition October 11, 2004.	R. Gilberg,B. Forouzan	Cenage Learning
Fundamentals of Data Structures in C, ISBN 8173716056	E. Horowitz, S.Sahani and S.Anderson-Freed	University Press, 2nd Edition 2007.
Let us C & Pointer in C, ISBN 9788183331630	Yashwant Kanitkar	BPB,13thEdition 2013 .
Research of shortest path algorithm based on the data structure	Software Engineering and Service Science (ICSESS)	NA

Course Outline:

Sr. No.	Topic	Actual Teaching Hours	Contact Hours Equivalence
1	Implement linear and binary search algorithms, then analyze and evaluate their time complexity	2	1
2	Implement Bubble, Selection, and Insertion sort algorithms, and analyze their time complexity	4	2
3	Implement Quick and Merge sort algorithms, and analyze their time complexity	2	1
4	Design and implement a menu-driven program for singly linked list operations (create, insert, delete, reverse, concatenate),), applying and analyzing their functionality.	4	2
5	Design and implement a menu-driven program for circular linked list operations (create, insert, delete, reverse, concatenate), applying and analyzing their functionality.	2	1
6	Develop a menu-driven program that implements doubly linked list operations (create, insert, delete, reverse, concatenate),), applying and analyzing their functionality.	4	2
7	Design and implement a menu-driven program to create a binary search tree, traverse it in inorder, preorder, and postorder, search for a node, and delete a node from the tree, demonstrating application and analysis of tree operations.	4	2
8	Develop a program to insert and delete nodes in a graph using an adjacency list representation, allowing for evaluation of graph structure modifications.	2	1
9	Write a program in C to implement Depth First Search (DFS) and Breadth First Search (BFS) on a graph, analyzing the performance and outcomes of each traversal method.	2	1

Design open-ended virtual lab experiments that focus on the following:			
10	Write a program to add two polynomials using a linked list, demonstrating the application of linked list structures to represent and manipulate polynomial expressions.	2	1
11	Develop a menu-driven program to implement stack operations including push, pop, overload, underload, and traversing, allowing for analysis of stack behavior and efficiency.	2	1
12	Create a menu-driven program to implement queue operations such as enqueue, dequeue, overload, underload, and traversing, enabling evaluation of queue management and performance characteristics.	2	1
Total		32 / 30	18 / 15

Evaluation:

A. Continuous Assessment: Lab Assignments, Open Ended Problems, virtual lab

B. End Semester Examination: Viva-Voce Lab Exam

Pedagogy:

Hands on Session Project
based Learning
HackerRank/ Github/ Virtual
Lab

CO-PO-Mapping:

The mapping is typically represented using a scale (1, 2, 3) where:

1: Low Contribution
2: Medium Contribution
3: High Contribution

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	**3**	**3**	**1**	**1**	**1**	**-**	**-**	**-**	**-**	**1**	**-**	**2**	**3**	**3**
CO2	**3**	**3**	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**1**	**-**	**2**	**3**	**3**
CO3	**3**	**3**	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**1**	**-**	**2**	**3**	**3**
CO4	**3**	**2**	**2**	**2**	**3**	**-**	**-**	**-**	**-**	**2**	**-**	**2**	**3**	**3**
CO5	**1**	**1**	**2**	**2**	**2**	**-**	**-**	**-**	**3**	**3**	**2**	**2**	**3**	**3**