

## SEMESTER S3

### DATA STRUCTURES LAB

(Common to CS/CA/CM/CD/CR/AI/AM/AD/CB/CN/CC/CU/CI/CG)

<b>Course Code</b>	<b>PCCSL307</b>	<b>CIE Marks</b>	<b>50</b>
<b>Teaching Hours/Week (L: T:P: R)</b>	<b>0:0:3:0</b>	<b>ESE Marks</b>	<b>50</b>
<b>Credits</b>	<b>2</b>	<b>Exam Hours</b>	<b>2 Hrs. 30 Min.</b>
<b>Prerequisites (if any)</b>	<b>GYEST204</b>	<b>Course Type</b>	<b>Lab</b>

#### Course Objectives:

To give practical experience for learners on implementing different linear and non linear data structures, and algorithms for searching and sorting.

<b>Expt. No.</b>	<b>Experiments</b>
<b>1</b>	Find the sum of two sparse polynomials using arrays
<b>2</b>	Find the transpose of a sparse matrix and sum of two sparse matrices.
<b>3</b>	Convert infix expression to postfix (or prefix) and then evaluate using stack,
<b>4</b>	Implement Queue, DEQUEUE, and Circular Queue using arrays.
<b>5</b>	Implement backward and forward navigation of visited web pages in a web browser (i.e. back and forward buttons) using doubly linked list operations.
<b>6</b>	Implement addition and multiplication of polynomials using singly linked lists.
<b>7</b>	Create a binary tree for a given simple arithmetic expression and find the prefix / postfix equivalent.
<b>8</b>	Implement a dictionary of word-meaning pairs using binary search trees.
<b>9</b>	Find the shortest distance of every cell from a landmine inside a maze.
<b>10</b>	We have three containers whose sizes are 10 litres, 7 litres, and 4 litres, respectively. The 7-litre and 4-litre containers start out full of water, but the 10-litre container is initially empty. We are allowed one type of operation: pouring the contents of one container into another, stopping only when the source container is empty or the destination container is full. We want to know if there is a sequence of pourings that leaves exactly 2 litres in the 7

	or 4-litre container. Model this as a graph problem and solve.
11	Implement the find and replace feature in a text editor.
12	Given an array of sorted items, implement an efficient algorithm to search for specific item in the array.
13	Implement Bubble sort, Insertion Sort, Radix sort, Quick Sort, and Merge Sort and compare the number of steps involved.
14	The General post office wishes to give preferential treatment to its customers. They have identified the customer categories as Defence personnel, Differently abled, Senior citizen, Ordinary. The customers are to be given preference in the decreasing order - Differently abled, Senior citizen, Defence personnel, Normal person. Generate the possible sequence of completion.
15	Implement a spell checker using a hash table to store a dictionary of words for fast lookup. Implement functions to check if a word is valid and to suggest corrections for misspelled words.
16	Simulation of a basic memory allocator and garbage collector using doubly linked list
17	The CSE dept is organizing a tech fest with so many exciting events. By participating in an event, you can claim for activity points as stipulated by KTU. Each event i gives you A[i] activity points where A is an array. If you are not allowed to participate in more than k events, what's the max number of points that you can earn?
18	Merge K sorted lists into a single sorted list using a heap. Use a min-heap to keep track of the smallest element from each list. Repeatedly extract the smallest element and insert the next element from the corresponding list into the heap until all lists are merged.

### Course Assessment Method

(CIE: 50 marks, ESE: 50 marks)

#### Continuous Internal Evaluation Marks (CIE):

Attendance	Preparation/Pre-Lab Work experiments, Viva and Timely completion of Lab Reports / Record (Continuous Assessment)	Internal Examination	Total
5	25	20	50

**End Semester Examination Marks (ESE):**

Procedure/ Preparatory work/Design/ Algorithm	Conduct of experiment/ Execution of work/ troubleshooting/ Programming	Result with valid inference/ Quality of Output	Viva voce	Record	Total
10	15	10	10	5	50

- *Submission of Record: Students shall be allowed for the end semester examination only upon submitting the duly certified record.*
- *Endorsement by External Examiner: The external examiner shall endorse the record*

**Course Outcomes (COs)**

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
<b>CO1</b>	Model a real world problem using suitable data structure and implement the solution.	<b>K3</b>
<b>CO2</b>	Compare efficiency of different data structures in terms of time and space complexity.	<b>K4</b>
<b>CO3</b>	Evaluate the time complexities of various searching and sorting algorithms.	<b>K5</b>
<b>CO4</b>	Differentiate static and dynamic data structures in terms of their advantages and application.	<b>K3</b>

Note: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create

**CO- PO Mapping (Mapping of Course Outcomes with Program Outcomes)**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
<b>CO1</b>	3	3	3	3				3				3
<b>CO2</b>	3	3	3	3				3				3
<b>CO3</b>	3	3	3	3				3				3
<b>CO4</b>	3	3	3	3				3				3

1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), -: No Correlation

<b>Text Books</b>				
<b>Sl. No</b>	<b>Title of the Book</b>	<b>Name of the Author/s</b>	<b>Name of the Publisher</b>	<b>Edition and Year</b>
1	Fundamentals of Data Structures in C	Ellis Horowitz, Sartaj Sahni and Susan Anderson-Freed,	Universities Press,	2/e, 2007
2	Introduction to Algorithms	Thomas H Cormen, Charles Leiserson, Ronald L Rivest, Clifford Stein	PHI	3/e, 2009

<b>Reference Books</b>				
<b>Sl. No</b>	<b>Title of the Book</b>	<b>Name of the Author/s</b>	<b>Name of the Publisher</b>	<b>Edition and Year</b>
1	Classic Data Structures	Samanta D.	Prentice Hall India.	2/e, 2018
2	Data Structures and Algorithms	Aho A. V., J. E. Hopcroft and J. D. Ullman	Pearson Publication.	1/e, 2003
3	Introduction to Data Structures with Applications	Tremblay J. P., P. G. Sorenson	Tata McGraw Hill.	2/e, 2017
4	Theory and Problems of Data Structures	Lipschutz S.	Schaum's Series	2/e, 2014

<b>Video Links (NPTEL, SWAYAM...)</b>	
<b>No.</b>	<b>Link ID</b>
1	<a href="https://nptel.ac.in/courses/106102064">https://nptel.ac.in/courses/106102064</a>
2	<a href="https://ocw.mit.edu/courses/6-851-advanced-data-structures-spring-2012/">https://ocw.mit.edu/courses/6-851-advanced-data-structures-spring-2012/</a>

## **Continuous Assessment (25 Marks)**

### **1. Preparation and Pre-Lab Work (7 Marks)**

- Pre-Lab Assignments: Assessment of pre-lab assignments or quizzes that test understanding of the upcoming experiment.
- Understanding of Theory: Evaluation based on students' preparation and understanding of the theoretical background related to the experiments.

### **2. Conduct of Experiments (7 Marks)**

- Procedure and Execution: Adherence to correct procedures, accurate execution of experiments, and following safety protocols.
- Skill Proficiency: Proficiency in handling equipment, accuracy in observations, and troubleshooting skills during the experiments.
- Teamwork: Collaboration and participation in group experiments.

### **3. Lab Reports and Record Keeping (6 Marks)**

- Quality of Reports: Clarity, completeness and accuracy of lab reports. Proper documentation of experiments, data analysis and conclusions.
- Timely Submission: Adhering to deadlines for submitting lab reports/rough record and maintaining a well-organized fair record.

### **4. Viva Voce (5 Marks)**

- Oral Examination: Ability to explain the experiment, results and underlying principles during a viva voce session.

***Final Marks Averaging: The final marks for preparation, conduct of experiments, viva, and record are the average of all the specified experiments in the syllabus.***

## **Evaluation Pattern for End Semester Examination (50 Marks)**

### **1. Procedure/Preliminary Work/Design/Algorithm (10 Marks)**

- Procedure Understanding and Description: Clarity in explaining the procedure and understanding each step involved.
- Preliminary Work and Planning: Thoroughness in planning and organizing materials/equipment.

- Algorithm Development: Correctness and efficiency of the algorithm related to the experiment.
- Creativity and logic in algorithm or experimental design.

**2. Conduct of Experiment/Execution of Work/Programming (15 Marks)**

- Setup and Execution: Proper setup and accurate execution of the experiment or programming task.

**3. Result with Valid Inference/Quality of Output (10 Marks)**

- Accuracy of Results: Precision and correctness of the obtained results.
- Analysis and Interpretation: Validity of inferences drawn from the experiment or quality of program output.

**4. Viva Voce (10 Marks)**

- Ability to explain the experiment, procedure results and answer related questions
- Proficiency in answering questions related to theoretical and practical aspects of the subject.

**5. Record (5 Marks)**

- Completeness, clarity, and accuracy of the lab record submitted