INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)
Dundigal, Hyderabad -500 043

MECHANICAL ENGINEERING

COURSE DESCRIPTOR

Course Title	**DATA STRUCTURES LABORATORY**				
Course Code	ACSB05				
Programme	B. Tech				
Semester	III	CSE | IT | ECE | CE| ME			
	IV	AE | EEE			
Course Type	Core				
Regulation	IARE - R18				
Course Structure	**Theory**			**Practical**	
	Lectures	**Tutorials**	**Credits**	**Laboratory**	**Credits**
	-	-	-	3	1.5
Chief Coordinator	Dr. J Sirisha Devi, Associate Professor				
Course Faculty	Mr. U Shivaji, Assistant Professor Ms. A Lakshmi, Assistant Professor				

I. COURSE OVERVIEW:

This course covers some of the general-purpose data structures and algorithms, and software development. It is aimed at helping students understand the reasons for choosing structures or algorithms. Topics covered include managing complexity, analysis, lists, stacks, queues, trees, graphs, balanced search trees and hashing mechanisms. The main objective of the course is to teach the students how to select and design data structures and algorithms that are appropriate for problems that they might encounter in real life. This course in reached to student by power point presentations, lecture notes, and lab involve the problem solving in engineering areas.

II. COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites	Credits
UG	ACSB01	II	Programming For Problem Solving	2

III. MARKS DISTRIBUTION:

Subject	SEE Examination	CIA Examination	Total Marks
Data Structures Laboratory	70 Marks	30 Marks	100

IV. DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✘	Chalk & Talk	✘	Quiz	✘	Assignments	✘	MOOCs
✔	LCD / PPT	✔	Seminars	✘	Mini Project	✔	Videos
✔	Open Ended Experiments						

V. EVALUATION METHODOLOGY:

Each laboratory will be evaluated for a total of 100 marks consisting of 30 marks for internal assessment and 70 marks for semester end lab examination. Out of 30 marks of internal assessment, continuous lab assessment will be done for 20 marks for the day to day performance and 10 marks for the final internal lab assessment.

Semester End Examination (SEE): The semester end lab examination for 70 marks shall be conducted by two examiners, one of them being Internal Examiner and the other being External Examiner, both nominated by the Principal from the panel of experts recommended by Chairman, BOS.

The emphasis on the experiments is broadly based on the following criteria:

20 %	To test the preparedness for the experiment.
20 %	To test the performance in the laboratory.
20 %	To test the calculations and graphs related to the concern experiment.
20 %	To test the results and the error analysis of the experiment.
20 %	To test the subject knowledge through viva – voce.

Continuous Internal Assessment (CIA):

CIA is conducted for a total of 30 marks (Table 1), with 20 marks for continuous lab assessment during day to day performance, 10 marks for final internal lab assessment.

Table 1: Assessment pattern for CIA

Component	Laboratory		Total Marks
Type of Assessment	Day to day performance	Final internal lab assessment	
CIA Marks	20	10	30

Continuous Internal Examination (CIE):

One CIE exams shall be conducted at the end of the 16th week of the semester. The CIE exam is conducted for 10 marks of 3 hours duration.

Preparation	Performance	Calculations and Graph	Results and Error Analysis	Viva	Total
2	2	2	2	2	10

VI. HOW PROGRAM OUTCOMES ARE ASSESSED:

Program Outcomes (POs)		Strength	Proficiency assessed by
PO1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	3	Videos/ StudentViva
PO2	**Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences	3	Lab Exercises/ StudentViva
PO3	**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.	2	Videos/ StudentViva
PO5	**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.	2	Lab Exercises
PO12	**Life-long learning:** Recognize the need for, and have the preparation and ability to engage independent and life-long learning in the broadest context of technological change.	2	Presentation on real-world problems

3 = High; 2 = Medium; 1 = Low

VII. HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program Specific Outcomes (PSOs)		Strength	Proficiency assessed by
PSO1	**Professional Skills:** To produce engineering professional capable of synthesizing and analyzing mechanical systems including allied engineering streams.	-	-
PSO2	**Software Engineering Practices:** An ability to adopt and integrate current technologies in the design and manufacturing domain to enhance the employability.	3	Lab Exercises
PSO3	**Successful Career and Entrepreneurship:** To build the nation, by imparting technological inputs and managerial skills to become technocrats.	2	Presentation on real-world problems

3 = High; 2 = Medium; 1 = Low

VIII. COURSE OBJECTIVES :

The course should enable the students to:	
I	Understand various data representation techniques in the real world.
II	Implement linear and non-linear data structures.
III	Analyze various algorithms based on their time and space complexity
IV	Develop real-time applications using suitable data structure
V	Identify suitable data structure to solve various computing problems.

IX. COURSE OUTCOMES (COs):

COs	Course Outcome	CLOs	Course Learning Outcome
CO 1	Understand the concept of data structures, python and apply algorithm for solving problems like sorting, searching, insertion and deletion of data.	CLO 1	Understand the basic concepts of python.
		CLO 2	Explore an algorithm to find the location of an element in a given list.
		CLO 3	Choose a suitable algorithm to organize the data in ascending or descending order.
CO 2	Understand linear data structures for processing of ordered or unordered data.	CLO 4	Implementation of stack and queues using lists.
		CLO 5	Understand application of stacks in arithmetic expression conversion and evaluation.
CO 3	Explore various operations on dynamic data structures like single linked list, circular linked list and doubly linked list.	CLO 6	Understand working and implementation of single linked list.
		CLO 7	Understand the basic operations like insertion and deletion operations associated with double linked list.
		CLO 8	Understand the basic operations like insertion and deletion operations associated with circular linked list.
		CLO 9	Understand working and implementation of stack and queue using linked list
CO 4	Explore the concept of non linear data structures such as trees and graphs.	CLO 10	Understand the concept of non-linear data structures viz. trees and graphs.
		CLO 11	Understand graphs and graph traversal techniques like Depth first search and Breadth first search.
CO 5	Understand the binary search trees, hash function, and concepts of collision and its resolution methods.	CLO 12	Understand the operations of binary search tree like tree traversals and counting the number of nodes in the binary search tree.

X. COURSE LEARNING OUTCOMES (CLOs):

CLO Code	CLO's	At the end of the course, the student will have the ability to:	PO's Mapped	Strength of Mapping
ACSB05.01	CLO 1	Understand the basic concepts of python.	PO1	3
ACSB05.02	CLO 2	Explore an algorithm to find the location of an element in a given list.	PO3	3
ACSB05.03	CLO 3	Choose a suitable algorithm to organize the data in ascending or descending order.	PO3,PO5	3
ACSB05.04	CLO 4	Implementation of stack and queues using lists.	PO1, PO5	3
ACSB05.05	CLO 5	Understand application of stacks in arithmetic expression conversion and evaluation.	PO1,PO 5	3
ACSB05.06	CLO 6	Understand working and implementation of single linked list.	PO3,PO5	3
ACSB05.07	CLO 7	Understand the basic operations like insertion and deletion operations associated with double linked list.	PO3,PO5	3
ACSB05.08	CLO 8	Understand working and implementation of stack and queue using linked list	PO3,PO5	3
ACSB05.09	CLO 9	Understand working and implementation of stack and queue using linked list	PO1,PO 5	3
ACSB05.10	CLO 10	Understand the concept of non-linear data structures viz. trees and graphs.	PO2,PO5	3
ACSB05.11	CLO 11	Understand graphs and graph traversal technique like Depth first search and Breadth first search.	PO2,PO5	3
ACSB05.12	CLO 12	Understand the operations of binary search tree like tree traversals and counting the number of nodes in the binary search tree.	PO2, PO3	3

3= High; 2 = Medium; 1 = Low

XI. MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcomes (COs)	Program Outcomes (POs)				Program Specific Outcomes(PSOs)		
	PO1	PO2	PO3	PO5	PSO1	PSO2	PSO3
CO 1	3		3	2		3	
CO 2	3			2			2
CO 3	3		3	2		3	
CO 4		3		2			
CO 5		3	3	2			2

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XII. MAPPING COURSE LEARNING OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Learning Outcomes (CLOs)	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CLO 1	3													3	
CLO 2			3												
CLO 3			3		2									3	
CLO 4	3				2										2
CLO 5	3				2										2
CLO 6	3				2									3	
CLO 7			3		2										
CLO 8			3		2									3	
CLO 9	3				2									3	
CLO 10		3			2										
CLO 11		3			2										
CLO 12		3	3		2										2

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XIII. ASSESSMENT METHODOLOGIES – DIRECT

CIE Exams	PO1, PO2,PO3 PO5, PO12,PSO1 PSO2,PSO3	SEE Exams	PO1,PO2,PO3 PO5,PO12, PSO1,PSO2 PSO3	Lab Exercises	PO5, PSO2	Seminars	PO12, PSO3
Laboratory Practices	PO1, PO5,PSO2	Student Viva	PO1, PO2 PO 3	Mini Project	-	Certification	-

XIV. ASSESSMENT METHODOLOGIES - INDIRECT

✔	Early Semester Feedback	✔	End Semester OBE Feedback
✘	Assessment of Mini Projects by Experts		

XV. SYLLABUS

WEEK-1	BASICS OF PYTHON
Write Python programs for the following: a. To find the biggest of given n numbers using control statements and lists b. To print the Fibonacci series using functions c. To find GCD of two numbers	

WEEK-2	SEARCHING TECHNIQUES
Write Python programs for implementing the following searching techniques. a. Linear search b. Binary search	
WEEK-3	**SORTING TECHNIQUES**
Write Python programs for implementing the following sorting techniques to arrange a list of integers in ascending order. a. Bubble sort b. Insertion sort c. Selection sort	
WEEK-4	**IMPLEMENTATION OF STACK AND QUEUE**
Write Python programs to a. Design and implement Stack and its operations using List. b. Design and implement Queue and its operations using List	
WEEK-5	**APPLICATIONS OF STACK**
Write Python programs for the following: a. Uses Stack operations to convert infix expression into postfix expression. b. Uses Stack operations for evaluating the postfix expression.	
WEEK-6	**IMPLEMENTATION OF SINGLE LINKED LIST**
a. Write Python programs for the following operations on Single Linked List. (i) Creation (ii) insertion (iii) deletion (iv) traversal	
WEEK-7	**IMPLEMENTATION OF CIRCULAR SINGLE LINKED LIST**
Write Python programs for the following operations on Circular Linked List. (i) Creation (ii) insertion (iii) deletion (iv) traversal	
WEEK-8	**IMPLEMENTATION OF DOUBLE LINKED LIST**
Write Python programs for the following: Uses functions to perform the following operations on Double Linked List. (i) Creation (ii) insertion (iii) deletion (iv) traversal in both ways.	
WEEK-9	**IMPLEMENTATION OF STACK USING LINKED LIST**
Write a Python program to implement Stack using linked list.	
WEEK-10	**IMPLEMENTATION OF QUEUE USING LINKED LIST**
Write a Python program to implement Linear Queue using linked list.	
WEEK-11	**GRAPH TRAVERSAL TECHNIQUES**
Write Python programs to implement the following graph traversal algorithms: a. Depth first search. b. Breadth first search.	
WEEK-12	**IMPLEMENTATION OF BINARY SEARCH TREE**
Write a Python program to perform the following: a. Create a binary search tree. b. Traverse the above binary search tree recursively in pre-order, post-order and in-order. c. Count the number of nodes in the binary search tree.	
TEXT BOOKS:	
1. Rance D. Necaise, "Data Structures and Algorithms using Python", Wiley Student Edition. 2. Benjamin Baka, David Julian, "Python Data Structures and Algorithms", Packt Publishers, 2017.	

REFERENCE BOOKS:

1. Y Daniel Liang, "Introduction to Programming using Python", Pearson.
2. Benjamin Baka, David Julian, "Python Data Structures and Algorithms", Packt Publishers,2017.
3. Rance D. Necaise, "Data Structures and Algorithms using Python", Wiley Student Edition.
4. Martin Jones, "Python for Complete Beginners", 2015.
5. Zed A. Shaw, "Learn Python the Hard Way: a very simple introduction to the terrifyingly beautiful world of computers and code", 3e, Addison-Wesley, 2014.
6. Hemant Jain, "Problem Solving in Data Structures and Algorithms using Python: programming interview guide", 2016.

WEB REFERENCES:

1. https://docs.python.org/3/tutorial/datastructures.html
2. http://interactivepython.org/runestone/static/pythonds/index.html
3. http://www.tutorialspoint.com/data_structures_algorithms
4. http://www.geeksforgeeks.org/data-structures/
5. http://www.studytonight.com/data-structures/
6. http://www.coursera.org/specializations/data-structures-algorithms

XVI. COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

Week No	Topics to be covered	Course Learning Outcomes (CLOs)	Reference
1	Basics of Python	CLO 1	R1:15.1
2	Searching Techniques	CLO 2	T1:5.1
3	Sorting Techniques	CLO 3	T1:5.2 R2 : 10.2
4	Implementation of Stack And Queue	CLO 4	T1:7.1 T1:8.1
5	Applications of Stack	CLO 5	T2:26.8
6	Implementation of Single Linked List	CLO 6	T1:9.2
7	Implementation of Circular Single Linked List	CLO 7	T2:26.14 R2:21.55
8	Implementation of Double Linked List	CLO 8	T1:7.2
9	Implementation of Stack Using Linked List	CLO 9	T1:7.2 R2:21.61
10	Implementation of Queue Using Linked List	CLO 10	T2:25.12 R2:21.24
11	Graph Traversal Techniques	CLO 11	T2:25.16 R2:21.29
12	Implementation of Binary Search Tree	CLO 12	T1:8.1

XVII. GAPS IN THE SYLLABUS-TO MEET INDUSTRY / PROFESSION REQUIREMENTS:

S No	Description	Proposed Actions	Relevance With POs	Relevance With PSOs
1	Updating latest version and new features of the Python language	Laboratory Sessions	PO5	PSO 1
2	Familiarizing the AVL Trees in developing application level programs.	Laboratory Sessions	PO1,PO2	-
3	Familiarizing different hashing techniques	Seminars	PO5	PSO3
4	Solving different problems and Practicing various debugging strategies to become a good programmer	Extra lab Sessions, Participating in Coding contests.	PO2	PSO3

Prepared by:
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