INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)
Dundigal, Hyderabad -500 043

ELECTRICAL AND ELECTRONICS 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	Ms. Y Harika Devi, Assistant Professor				
Course Faculty	Mr. U Shivaji, Assistant Professor Ms. Y Harika Devi, Assistant Professor				

I. COURSEOVERVIEW:

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 mathematical and engineering areas.

II. COURSEPRE-REQUISITES:

Level	Course Code	Semester	Prerequisites	Credits
UG	ACSB01	II	Programming For Problem Solving	3

III. MARKSDISTRIBUTION:

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. EVALUATIONMETHODOLOGY:

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 hoursduration.

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

VI. HOW PROGRAM OUTCOMES AREASSESSED:

	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/ Student Viva
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 AREASSESSED:

	Program Specific Outcomes (PSOs)	Strength	Proficiency assessed by
PSO1	**Professional Skills:** The ability to understand, analyze and develop computer programs in the areas related to algorithms, system software, multimedia, web design, big data analytics, and networking for efficient design of computer-based systems of varying complexity.	3	Videos
PSO2	**Problem-Solving Skills:** The ability to apply standard practices and strategies in software project development using open-ended programming environments to deliver a quality product forbusiness success.	3	Lab Exercises

Program Specific Outcomes (PSOs)		Strength	Proficiency assessed by
PSO3	**Successful Career and Entrepreneurship:** The ability to employ modern computer languages, environments, and platforms in creating innovative career paths to be an entrepreneur, and a zest forhigher studies.	1	Presentation on real-world problems

3 = High; 2 = Medium; 1 = Low

VIII. COURSE OBJECTIVES(COs):

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 forprocessing 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 linkedlist.	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 andgraphs.	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 searchtree.

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 ofsingle 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 ofstack and queue using linked list	PO3,PO5	3
ACSB05.09	CLO 9	Understand working and implementation ofstack 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	Understandgraphsandgraphtraversaltechniques 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 SPECIFICOUTCOMES:

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			2
CO 4		3		2			
CO 5		3	3	2			2

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

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

3 = High; 2 = Medium; 1 = Low

XIII. ASSESSMENT METHODOLOGIES –DIRECT

CIE Exams	-	SEE Exams	PO 1, PO2 PO 3, PO5	Lab Exercises	PO 5	Seminars	PO 1, PO2
Laboratory Practices	PO 1, PO 5	Student Viva	PO 1, PO 2 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 andlists b. To print the Fibonacci series usingfunctions c. To find GCD of twonumbers	

WEEK-2	SEARCHING TECHNIQUES

Write Python programs for implementing the following searching techniques.
 a. Linearsearch
 b. Binarysearch

WEEK-3	SORTING TECHNIQUES

Write Python programs for implementing the following sorting techniques to arrange a list of integers in ascending order.

a. Bubblesort

b. Insertionsort

 c. Selectionsort

WEEK-4	IMPLEMENTATION OF STACK AND QUEUE

Write Python programs to
 a. Design and implement Stack and its operations usingList.
 b. Design and implement Queue and its operations usingList

WEEK-5	APPLICATIONS OF STACK

Write Python programs for the following:

a. Uses Stack operations to convert infix expression into postfixexpression.

b. Uses Stack operations for evaluating the postfixexpression.

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 firstsearch.
b. Breadth firstsearch.

WEEK-12	IMPLEMENTATION OF BINARY SEARCH TREE

Write a Python program to perform the following:
 a. Create a binary searchtree.
 b. Traverse the above binary search tree recursively in pre-order, post-order andin-order.
c. Count the number of nodes in the binary searchtree.

TEXT BOOKS:

 1. Rance D. Necaise, "Data Structures and Algorithms using Python", Wiley StudentEdition.
 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", PacktPublishers,2017.
3. Rance D. Necaise, "Data Structures and Algorithms using Python", Wiley StudentEdition.

4. Martin Jones, "Python for Complete Beginners",2015.
5. ZedA.Shaw,"LearnPythontheHardWay:averysimple introductiontotheterrifyinglybeautiful world of computers and code", 3e, Addison-Wesley,2014.
6. HemantJain,"ProblemSolvinginDataStructuresandAlgorithmsusingPython: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. COURSEPLAN:

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 / PROFESSIONREQUIREMENTS:

S No	Description	Proposed actions	Relevance with POs	Relevance with PSOs
1	Updating latest version and new features of the Python language	Laboratory Sessions	PO 5	PSO 1
2	Familiarizing the AVL Trees in developing application level programs.	Laboratory Sessions	PO 1, PO 2	-
3	Familiarizing different hashing techniques	Seminars	PO 5	PSO 3

4	Solving different problems and Practicing various debugging strategies to become a good programmer	Extra Lab Sessions, Participating in Codingcontests.	PO 2	PSO 3

Prepared by:
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