SETHU INSTITUTE OF TECHNOLOGY

(An Autonomous Institution| Accredited with 'A++' Grade by NAAC)

Pulloor, Kariapatti –Taluk. Virudhunagar Dist-626115.

DEPARTMENT OF INFORMATION TECHNOLOGY

INSTITUTE VISION

To promote excellence in technical education and scientific research for the benefit of the society.

INSTITUTE MISSION

- To provide quality technical education to fulfill the aspiration of the student and to meet the needs of the Industry.
- To provide holistic learning ambience.
- To impart skills leading to employability and entrepreneurship.
- To establish effective linkage with industries.
- To promote Research and Development activities.
- To offer services for the development of society through education and technology.

CORE VALUES

- Quality
- Commitment
- Innovation
- Team work
- Courtesy

QUALITY POLICY

- To provide Quality technical education to the students
- To produce competent professionals and contributing citizens
- To contribute for the upliftment of the society

DEPARTMENT VISION

- To promote excellence in producing competent IT professionals to serve the society through technology and research.

DEPARTMENT MISSION

- Producing Competent Professionals in Information and Communication Technologies
- Educating the Students with the State of Art Computing Environment and Pedagogical Innovations
- Encouraging Entrepreneurship and Imparting Skills for Employability
- Establishing Collaboration with IT and Allied Industries
- Promoting Research in Information and Communication Technology to Improve the Quality of Human Life
- Offering Beneficial Service to the Society by Inculcating Knowledge and Providing IT Solutions

PROGRAM EDUCATIONAL OBJECTIVES

PEO 1	Exhibit Proficiency in Analyzing, Designing and Developing IT Based Solutions to Cater to the Business and Societal Needs. **{Technical Competence}**
PEO 2	Provide Professional Expertise to the Industry and Society with Effective Communication and Ethics. **{Professionalism}**
PEO 3	Engage in Lifelong Learning for Professional Development and Research. **{Life-Long Learning}**

PROGRAM SPECIFIC OUTCOMES	
PSO – 1	Design Software Solutions Using Programming Skills and Computing Technologies.
PSO – 2	Design and Implement Data Communication System Using Various IT Components.

PROGRAM OUTCOMES	
1.	Apply the knowledge of Mathematics, Basic Science, Computer and communication Fundamentals to solve complex problems in Information Technology. **[Engineering Knowledge]**
2.	Identify, formulate, review research literature and analyze complex problems reaching concrete conclusions using principles of mathematics, Engineering sciences and Information Technology. **[Problem Analysis]**
3.	Design solution for complex information and communication engineering problems and design system components or processes that meet with realistic constraints for public health and safety, cultural, societal and environment considerations. **[Design/Development of Solutions]**
4.	Conduct investigations of complex Information technology related problems using research based knowledge and research methods including design of experiments, analysis and interpretation of data to provide valid conclusions through synthesis of information. **[Conduct investigations of complex problems]**
5.	Create, select and apply appropriate techniques, resources and modern IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations. **[Modern Tool Usage]**
6.	Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and consequent responsibilities relevant to professional engineering practice. **[The Engineer and Society]**
7.	Understand the impact of professional engineering solutions in societal and environmental contexts and demonstrate the knowledge of and need for sustainable development. **[Environment and sustainability]**
8.	Apply ethical principles and commit to professional ethics and responsibilities through the norms of professional engineering practice. **[Ethics]**
9.	Function effectively as an individual and as a member or leader in diverse teams and in multidisciplinary settings. **[Individual and Team Work]**
10.	Communicate effectively with the engineering community and the 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. **[Communication]**
11.	Demonstrate knowledge and understanding of engineering and management principles and apply these to one's own work, as a member /or leader in a team, to manage projects in multi-disciplinary environment. **[Project Management and Finance]**
12.	Recognize the need for, and have the preparation and ability to engage in independent and Life-long learning in broadest context of technological change. **[Life-long Learning]**

R21UIT302	DATA STRUCTURES (Common to CSE,IT,AIDS,CSD,AIML, IoT&Cyber Security)	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

• To introduce the fundamental concept of data structures and to emphasize the importance of data structures in developing and implementing efficient algorithms.

• To impart a thorough understanding of linear non-linear data structures such as list, stacks, queues, trees, graphs and their applications.

• To impart familiarity with various sorting, searching and hashing techniques and their performance comparison.

UNIT I	
LINEAR DATA STRUCTURE - LIST	**9**
Abstract Data Type- List ADT- linked list implementation - singly linked lists - doubly-linked lists - circularly linked lists – Applications.	
UNIT II	
LINEAR DATA STRUCTURE – STACK & QUEUE	**9**
Stack ADT - Operations - Applications – Balancing Symbols - Infix to postfix conversion -Evaluation of postfix expressions– Function Calls - Queue ADT - Operations - Circular Queue - applications of queues.	
UNIT III	
NON-LINEAR DATA STRUCTURE – TREES & HEAP	**9**
Tree - Introduction - Binary trees –Expression Tree - Binary Search Tree - Insert – Delete - Search - AVL Trees – Single Rotations – Double Rotations - B Trees - Priority Queue(Heaps) - Model – Simple implementations – Binary Heap	
UNIT IV	
NON-LINEAR DATA STRUCTURE - GRAPH	**9**
Graph - Introduction - Representation of Graphs - Shortest path algorithm - Dijkstra‘s algorithm - Minimum Spanning Trees - Prim‘s and Kruskal‘s Algorithm - Applications of Depth first Search and Breath first search	
UNIT V	
SEARCHING, SORTING AND HASHING	**9**
Searching - Linear Search - Binary Search – Sorting - Insertion Sort - Merge sort - Quick sort – Hashing - Hash Functions - Separate Chaining - Open Addressing	
TOTAL : 45 Periods	

TEXT BOOKS

1. Weiss. M.A, "Data Structures and Algorithm Analysis in C", Pearson Education, 2nd Edition, 2012.
2. ReemaThareja, “Data Structures Using C”, Oxford University Press, Second Edition, 2014.

REFERENCE BOOKS

1. Aaron M.Tenenbaum, YedidyahLangsam, Moshe J.Augenstein, "Data Structures using C", Pearson Education India, 7th Edition, New Delhi, 2009.
2. Aho.V, Hopcroft.J.E, Ullman.J.D, "Data Structures and Algorithms", Pearson Education, 1st Edition Reprint, 2006.
3. Gilberg.R.F, Forouzan.B.A, "Data Structures", Thomson India Education, 2nd Edition, 2005.
4. Sara Baase and A.VanGelder, "Computer Algorithms", Pearson Education, 3rd Edition, 2005.
5. Cormen.T.H, C.A.Leiserson.B.A, R.L.Rivest and C.Stein, "Introduction to Algorithms", Prentice Hall of India, 3rd Edition, 2009.

CO.No	Course Outcome	Taxonomy level	Domain	PO & PSO Mapping
CO1	Understand the basic concepts of various linear and non-linear data structures.	Understand	Cognitive	-
CO2	Apply the knowledge of different types of data structures to find solutions for solving complex engineering problems	Apply	Cognitive	PO1, PSO1
CO3	Analyze various data structures algorithms by finding an optimal solution for a real world problem.	Analyze	Cognitive	PO2, PSO1
CO4	Evaluate various algorithms to improve the efficiency and effectiveness in a complex engineering problem.	Evaluate	Cognitive	PO4, PSO1
CO5	Build innovative solutions for complex computational problems by Integrating multiple algorithms in data structures.	Create	Cognitive	PO5,PSO1
CO6	Work individually or in teams and demonstrate the solutions to the given problems through presentation.	Value	Affective	PO9, PO10. PSO1

LESSON PLAN SHEET

		Lecture Schedule		
		R21UIT302 - DATA STRUCTURES		
Lecture	**Unit**	**Topic**	**Text/ Reference Books**	**Remarks**
UNIT 1 – LINEAR DATA STRUCTURE – LIST				
1.	1	Abstract Data Type	T1(57-58)	
2.	1	List ADT : linked list implementation	T1(58-59)	
3.	1	Singly linked lists	T1(57-58)	Visualization-visualgo Tool
4.	1	Singly linked lists: Implementation	T1(59-65)	
5.	1	Doubly linked lists	T1(67-68)	
6.	1	Doubly linked lists Implementation	T1(67-68)	Visualization-visualgo Tool
7.	1	Circular linked lists	T1(68-69)	
8.	1	Circular linked lists Implementation	T1(68-69)	
9.	1	Applications.	T1(69-70)	
UNIT 2 - LINEAR DATA STRUCTURE – STACK, QUEUE				
1.	2	Stack ADT Operations Applications	T1 (78-79)	Visualization-visualgo Tool
2.	2	Stack ADT : Implementation	T1 (79-86)	
3.	2	Balancing Symbols	T1 (87-90)	
4.	2	Infix to postfix conversion	T1 (90-93)	
5.	2	Evaluation of postfix expressions	T1 (90-93)	
6.	2	Function Calls	T1 (93-94)	
7.	2	Queue ADT - Operations	T1 (95-96)	Flipped Classroom
8.	2	Circular Queue	T1 (97-98)	
9.	2	applications of queues	T1 (100-101)	
UNIT 3 – NON -LINEAR DATA STRUCTURE – TREE, HEAP				
1.	3	Tree - Introduction	T1 (105-107)	
2.	3	Binary trees	T1 (111-113)	Think-Pair-Share
3.	3	Expression Tree	T1 (113-116)	
4.	3	Binary Search trees: Insert – Delete - Search	T1 (116-125)	Visualization-visualgo Tool

5.	3	AVL Trees: Single Rotation	T1 (126 -131)	
6.	3	AVL Trees : Double Rotation	T1 (131 -135)	
7.	3	B Trees	T1 (149 - 154)	
8.	3	Priority Queue(Heaps) – Model- Simple implementations	T1 (193 -194)	
9.	3	Binary Heap	T1 (195 -196)	
UNIT 4 – NON-LINEAR DATA STRUCTURE – GRAPH				
1.	4	Graph - Introduction	T1(299 -300)	
2.	4	Representation of Graphs	T1(300 – 302)	
3.	4	Shortest path algorithm	T1(306 -311)	
4.	4	Shortest path algorithm:Implementation	T1(306 -311)	
5.	4	Dijkstra‘s algorithm :Implementation	T1(311 - 317)	
6.	4	Minimum Spanning Trees : Prim‘s and Kruskal‘s Algorithm	T1(329-335)	Think – Pair – Share
7.	4	Minimum Spanning Trees : Prim‘s and Kruskal‘s Algorithm	T1(329-335)	
8.	4	Prim‘s and Kruskal‘s Algorithm :Implementation	T1(329-335)	
9.	4	Applications of Depth first Search and Breath first search	T1(335 - 338)	
Unit 5 - SEARCHING, SORTING AND HASHING				
1.	5	Searching: Linear Search	T1(250 -251)	
2.	5	Binary Search	T1(251 -253)	
3.	5	Searching : Implementation	T1(254 -256)	
4.	5	Sorting: Insertion Sort	T1(235 -236)	Visualization-visualgo Tool
5.	5	Merge sort - Quick sort	T1(236 -261)	
6.	5	Sorting : Implementation	T1(236 -261)	
7.	5	Hashing: Hash Functions	T1(165-166)	Visualization-visualgo Tool
8.	5	Separate Chaining – Open Addressing	T1(168 - 173)	
9.	5	Separate Chaining – Open Addressing	T1(173 - 180)	
Content beyond the syllabus: Red Black Tree- Properties and Operations T1(327-337)				

Continuous Internal Assessment Apportionment (for 40 marks of CIE - Theory)

Component	Number of Assessment tools	Assessment Details	Marks
Internals / Alternate Assessment (Mini Project)	2	PT-I,PT-II	60
Assignment 1	1	Individual	40
Assignment 2	1	Group	100
Total			200 (Converted to 40)

Question Pattern (Periodical Test –I& II)

10*2 marks =20 marks

5*16 marks=80 marks

Question Pattern (End Semester Exam)

10*2 marks =20 marks

5*16 marks=80 marks

End Semester Exam	2 Marks	16 Marks
Unit - I	2 Questions	1 Question
Unit - II	2 Questions	1 Question
Unit - III	2 Questions	1 Question
Unit - IV	2 Questions	1 Question
Unit - V	2 Questions	1 Question
	10*2 = 20 Marks	**5*16 = 80 Marks**

Micro-level Audit of Assessment Tool(s) used

Test Name	Q. No.	Remember/ Understand	Apply	Analyze	Evaluate	Create & Modern tool usage	Communication/ Presentation	Total Marks
Test -I	1	2						2
	2	2						2
	3			2				2
	4	2						2
	5		2					2
	6			2				2
	7		2					2
	8		2					2
	9		2					2
	10		2					2
	11	16						16
	12		16					16
	13		16					16
	14		16					16
	15		16					16
Test-II	1			2				2
	2	2						2
	3	2						2
	4		2					2
	5			2				2
	6	2						2
	7	2						2
	8	2						2
	9		2					2
	10			2				2
	11		16					16
	12		16					16
	13		16					16
	14		16					16
	15	16						16
Assignment	**1**	**10**	**10**	**15**	**25**			**60**
	2	**10**	**10**	**20**	**20**	**20**	**20**	**100**
Total Marks		**68**	**162**	**45**	**45**	**20**	**20**	**360**

SL.NO	Percentage questions towards GA Attribute (50 MARKS)	Level (Weight)
1	>=12% of total marks (50)	3
2	>=6% and <=11% of total marks (50)	2
3	<=5% of total marks (50)	1

Assessment Tool Mapping to CO-Theory

Test Name	CO1	CO2	CO3	CO4	CO5	CO6	Total
Test–I	22	74	4				100
Test-II	26	68	6				100
Assignment 1	10	10	15	25			60
Assignment 2	10	10	20	20	20	20	100
Total Marks	**68**	**162**	**45**	**45**	**20**	**20**	360
Percentage	**18**	**45**	**12.5**	**12.5**	**6**	**6**	100

Performance Indicators:

Competency addressed in the course and corresponding performance indicators

Competency	Performance Indicators
PO 1.7: Demonstrate competence in specialized engineering knowledge to the program	1.7.1 Apply theory and principles of computer science and engineering to solve an engineering problem
PO 2.1: Demonstrate an ability to identify and formulate complex engineering problem	2.5.1 Identify processes/modules/algorithms of a computer-based system and parameters to solve a problem 2.5.3 Identify mathematical algorithmic knowledge that applies to a given problem
PO 3.6: Demonstrate an ability to generate a diverse set of alternative design solutions	3.6.2 Able to produce a variety of potential design solutions suited to meet functional requirements.
PO 4.5: Demonstrate an ability to design experiments to solve open-ended problems	4.5.1 Design and develop appropriate procedures/ methodologies based on the study objectives
PO 5.5: Demonstrate an ability to select and	5.5.2 Demonstrate proficiency in using

apply discipline specific tools, techniques and resources	discipline-specific tools
PO 9.5: Demonstrate effective individual and team operations-- communication, problem-solving, conflict resolution and leadership skills	8.5.1 Demonstrate effective communication, problem-solving, conflict resolution and leadership skills
PO 10.5: Demonstrate competence in listening, speaking, and presentation	9.5.2 Deliver effective oral presentations to technical and non-technical audiences

CO – PO Mapping

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
Understand the basic concepts of various linear and non-linear data structures.														
Apply the knowledge of different types of data structures to find solutions for solving complex engineering problems	3												3	
Analyze various data structures algorithms by finding an optimal solution for a real world problem.		3											3	
Evaluate various algorithms to improve the efficiency and effectiveness in a complex engineering problem.				3									3	
Build innovative solutions for complex computational problems by Integrating multiple algorithms in data structures					2								2	
Work individually or in teams and demonstrate the solutions to the given problems through presentation.								2	2				2	
Course Articulation Matrix (CAM)	3	3	2	3	2					2	2		3	

RUBRICS FOR ASSIGNMENT EVALUATION

INDIVIDUAL / GROUP ASSIGNMENT - I

Component	**Excellent (20 Marks)**	**Good (15 Marks)**	**Average (10 Marks)**	**Poor (5 Marks)**
Description of Concepts and Technical Details.**(CO1 and CO2)** (20)	Complete explanation of the key concepts and strong description of the technical requirements of the topic.	Complete explanation of the key concepts but sufficient description of the technical requirements of the topic.	Complete explanation of the key concepts and insufficient description of the technical requirements of the topic	Inappropriate Complete explanation of the key concepts and poor description of the technical requirements of the topic.
Component	**Excellent (15 Marks)**	**Good (10 Marks)**	**Average (5 Marks)**	**Poor (2 Marks)**
Analyze the problem (10) **(CO3)**	Demonstrates the ability to construct a clear and insightful problem statement with evidence of all relevant factors	Begins to demonstrate the ability to construct problem statement with evidence of most relevant contextual factors, but problem statement is not complete	Demonstrates limited ability in identifying a problem statement or related contextual factors	Demonstrates an inability in identifying a problem statement or related contextual factors
Component	**Excellent (25 Marks)**	**Good (20 Marks)**	**Average (15 Marks)**	**Poor (8 Marks)**
Evalute the performance (10) **(CO4)**	Optimal Solutions reached by evaluating the various performances.	Partial optimal Solutions reached by evaluating the various performances.	Needs improvements.	Inappropriate explanation of the key concepts

RUBRICS GROUP ASSIGNMENT - II

S.NO.	**CONTENTS**	**LEVEL**	**CO'S**	**MARK ALLOCATION**
1.	Problem Identification	Understand	**CO1**	**10**
2.	Implementation	Apply	**CO2**	**10**
3.	Problem analysis	Analyze	**CO3**	**20**
4.	Evaluation	Evaluate	**CO4**	**20**
5.	Create using Engineering tool usage	Create	**CO5**	**20**
6.	Communication	Value	**CO6**	**10**
7.	Presentation	Value	**CO6**	**10**
Total				**100 Marks**

CONTENTS 10 Marks	Excellent 10 - 08 Marks	Good 07 –05 Marks	Average 05 - 03 Marks	Poor 03 – 0 Marks
Problem Identification (CO1)	Demonstrates the ability to construct a clear and insightful problem statement with evidence of all relevant factors	Begins to demonstrate the ability to construct problem statement with evidence of most relevant contextual factors, but problem statement is not complete	Demonstrates limited ability in identifying a problem statement or related contextual factors	Demonstrates an inability in identifying a problem statement or related contextual factors
Implementation (CO2)	Optimal Solutions reached by evaluating the various performances.	Partial optimal Solutions reached by evaluating the various performances.	Needs improvements.	Inappropriate explanation of the key concepts
Communication (CO6)	Good in Communication	Moderate in Communication	Average in communication	Not understandable
Presentation (CO6)	Communicate the technical information effectively.	Communicate the technical information moderately.	Some parts were clear.	Not understandable

CONTENTS 20 Marks	Excellent 20- 15 Marks	Good 15 – 10 Marks	Average 10 – 05 Marks	Poor 05 – 0 Marks
Problem Analysis (CO3)	Analysis performed perfectly Main points well developed with high quality and quantity support and Reveals high degree of optimal solution	Analysis is adequate with minimal mistakes in defining the structural model	Analysis is Average with mistakes in defining the structural model	Analysis is not performed or done entirely wrong
Evaluation (CO4)	The given problems were identified and evaluated with appropriate algorithm, executed with perfect solution.	Main points well developed with quality supporting details and quantity. Critical thinking is weaved into points	Main points are present with limited detail and development. Some critical thinking is present.	Not understandable
Create using Modern tool usage (CO5)	Appropriate usage of tools	Tool used is satisfied.	Tool used is Not satisfied.	No tools were used.

Course Instructors, HoD-IT

Dr.G.Rajalakshmi AP/IT, Mr.P.Ashok Ram AP/IT