	Course Title: Design and Analysis of Algorithms		
	Scheme (L:T:P) : **4:0:0**	Total Contact Hours: **52**	Course Code: **15CS53T**
	Type of Course: **Lectures, Self Study & Student Activity.**	Credit **:04**	Core/ Elective: **Core**
CIE- 25 Marks			SEE- 100 Marks

Prerequisites:

Knowledge of Data Structures.

Course Objectives

Study the concepts of fundamentals of algorithm, Analysis of algorithm efficiency, Brute force techniques, Divide-and-Conquer, Decrease-and-Conquer, Greedy techniques.

Course Outcome

On successful completion of the course, the students will be able to attain below Course Outcome (CO):

	Course outcome	CL	Linked PO	Teaching Hours
CO1	Discuss the fundamentals of algorithm.	*R,U*	**1,2,3,7,8,9,10**	**10**
CO2	Describe the analysis of algorithm efficiency using different notations.	*R,U,A,AL*	**1,2,3,7,8,9,10**	**10**
CO3	Discuss various problems using Brute force technique.	*U,A,AL*	**1,2,3,7,8,9,10**	**12**
CO4	Describe various problems using Divide-and-Conquer Technique.	*U,A,AL*	**1,2,3,7,8,9,10**	**08**
CO5	Describe various problems using Decrease-and-Conquer	*U,A,AL*	**1,2,3,7,8,9,10**	**06**
CO6	Discuss Greedy Techniques	*U,A*	**1,2,3,7,8,9,10**	**06**
			Total	**52**

Legends: R = Remember U= Understand; A= Apply AL=Analyze E=Evaluate C= Create and above levels (Bloom's revised taxonomy)

Course-PO Attainment Matrix

Course	Programme Outcomes									
	1	2	3	4	5	6	7	8	9	10
Design and Analysis of Algorithms	**3**	**3**	**3**	**-**	**-**	**-**	**3**	**3**	**3**	**3**

Course Content and Blue Print of Marks for SEE

Unit No	Unit Name	Hour	Questions to be set for SEE				Marks Weightage	Marks Weightage (%)
			R	U	A	AL	A	
I	Introduction	**10**	10	15	05	-	30	20.68
II	Fundamentals of the Analysis of Algorithm Efficiency	**10**	05	05	10	10	30	20.68
III	Brute Force	**12**		10	10	15	35	24.14
IV	Divide-and-Conquer	**08**	-	05	05	10	20	13.79
V	Decrease-and-Conquer	**06**	-	05	05	05	15	10.35
VI	Greedy Technique	**06**	-	05	05	05	15	10.35
	Total	**52**	**15**	**45**	**40**	**45**	**145**	**100**

UNIT I : Introduction   10 Hrs

What is an Algorithm? Fundamentals of Algorithmic problem solving, Important problem types. Fundamental data structures

UNIT II: Fundamentals of the Analysis of Algorithm Efficiency   10 Hrs

Analysis Framework, Measuring the input size, Units for measuring Running time, Orders of Growth, Worst-case, Best-case and Average-case efficiencies, Asymptotic Notations and Basic Efficiency classes, Informal Introduction, O-notation, Ω-notation, θ-notation, mathematical analysis of non-recursive algorithms, mathematical analysis of recursive algorithms.

UNIT III: Brute Force & Exhaustive Search   12 Hrs

Introduction to Brute Force approach, Selection Sort and Bubble Sort, Sequential search, Exhaustive Search- Travelling salesman Problem and Knapsack Problem, Depth First Search, Breadth First Search

UNIT IV: Divide-and-Conquer   08 Hrs

Introduction, Merge Sort, Quick Sort, Binary Search, Binary Tree traversals and related properties.

UNIT V: Decrease-and-Conquer   06 Hrs

Directorate of Technical Education   Karnataka State   CS&E   15CS53T

Decrease-and-Conquer: Introduction**,** Insertion Sort, Topological Sorting.

UNIT VI: Greedy Technique	06 Hrs

Greedy Technique: Introduction**,** Prim's Algorithm, Kruskal's Algorithm, Dijkstra's Algorithm

📚Text books
1. **Introduction to the Design and Analysis of Algorithms**, 3rd edition, Anany Levitin, Pearson Publication, ISBN: 9789332583771

References
1. http://nptel.ac.in/courses/106101060/
2. http://www.tutorialspoint.com/data_structures_algorithms/
3. Design & Analysis of Algorithms, S. Nandagopalan, Sapna Book House.

Suggested list of student activities

Note: the following activities or similar activities for assessing CIE (IA) for 5 marks (Any one)
Student activity like mini-project, surveys, quizzes, etc.
1. Each individual student should do any one of the following type activity or any other similar activity related to the course and before conduction, get it approved from concerned course coordinator and programme coordinator.
2**.** Each student should conduct different activity and no repeating should occur

1	Build and execute programs from the unsolved exercises given from the course textbook at the end of each chapters.
2	Quiz

Course Delivery

The course will be delivered through lectures and Power point presentations/ Video

Course Assessment and Evaluation Scheme

Method		What		To whom	When/Where (Frequency in the course)	Max Marks	Evidence collected	Course outcomes
Direct Assessment		CIE	IA	Students	Three IA tests (Average of three tests will be computed)	20	Blue books	1 to 6
					Student activities	05	Report	1 to 6
					Total	**25**		
		SEE	End Exam		**End of the course**	**100**	Answer scripts at BTE	1 to 6
Indirect Assessment				Students	Middle of the course		Feedback forms	1, 2, 3 Delivery of course
		End of Course Survey			End of the course		Questionnaires	1 to 6 Effectiveness of Delivery of instructions & Assessment Methods

Note: I.A. test shall be conducted for 20 marks. Average marks of three tests shall be rounded off to the next higher digit.

Directorate of Technical Education   Karnataka State   CS&E   15CS53T

Questions for CIE and SEE will be designed to evaluate the various educational components (Bloom's taxonomy) such as:

Sl. No	Bloom's Category	%
1	Remembrance	10
2	Understanding	30
3	Application	30
4	Analysis	30

Note to IA verifier: *The following documents to be verified by CIE verifier at the end of semester*

1. Blue books (20 marks)
2. Student suggested activities report for 5 marks
3. Student feedback on course regarding Effectiveness of Delivery of instructions & Assessment Methods.

FORMAT OF I A TEST QUESTION PAPER (CIE)

Test/Date and Time	Semester/year	Course/Course Code	Max Marks
Ex: I test/6 th week of sem 10-11 Am	V SEM		20
	Year:		

Name of Course coordinator :
Units:__ CO's:____

Question no	Question	MARKS	CL	CO	PO
1					
2					
3					
4					

Note: Internal choice may be given in each CO at the same cognitive level (CL).

MODEL QUESTION PAPER (CIE)

Test/Date and Time	Semester/year	Course/Course Code	Max Marks
Ex: I test/6 th week of sem 10-11 AM	V SEM	**Design and Analysis of Algorithms**	20
	Year: 2017-18	Course code: **15CS53T**	

Name of Course coordinator :
Units:1,2 Co: 1,2

Note: Answer all questions

Question no	Question	CL	CO	PO
1	Explain Euclid's algorithm for computing GCD of two numbers.(5) **OR** Explain Linear data structures with example. (5)	U, A	1,2	1,2,3,7,8, 9,10
2	Write an algorithm for sequential search and analyse its worst-case, best-case and average-case efficiencies. (5) OR Write a recursive algorithm for computing the factorial	U, A	1,2	1,2,3,7,8, 9,10

Directorate of Technical Education   Karnataka State   CS&E   15CS53T

	function for an arbitrary non-negative integer.(5)			
3	Apply selection sort to the following array 45,23,89,10,11,27,38 (5)	A, AL	2	1,2,3,7,8, 9,10
4	Differentiate undirected and directed graphs with examples. (5)	U	1	1,2,3,7,8, 9,10

Format for Student Activity Assessment

DIMENSION	Unsatisfactory 1	Developing 2	Satisfactory 3	Good 4	Exemplary 5	Score
Collection of data	Does not collect any information relating to the topic	Collects very limited information; some relate to the topic	Collects some basic information; refer to the topic	Collects relevant information; concerned to the topic	Collects a great deal of information; all refer to the topic	3
Fulfill team's roles & duties	Does not perform any duties assigned to the team role	Performs very little duties	Performs nearly all duties	Performs all duties	Performs all duties of assigned team roles with presentation	4
Shares work equally	Always relies on others to do the work	Rarely does the assigned work; often needs reminding	Usually does the assigned work; rarely needs reminding	Does the assigned job without having to be reminded.	Always does the assigned work without having to be reminded and on given time frame	3
Listen to other Team mates	Is always talking; never allows anyone else to speak	Usually does most of the talking; rarely allows others to speak	Listens, but sometimes talk too much	Listens and contributes to the relevant topic	Listens and contributes precisely to the relevant topic and exhibit leadership qualities	3
					TOTAL	**13/4=3.25=4**

Note: This is only an example. Appropriate rubrics/criteria may be devised by the concerned course co-ordinator for assessing the given activity.

**MODEL QUESTION PAPER**   Code: **15CS53T**
Diploma in Computer Science & Engineering
V Semester
Course Title: Design and Analysis of Algorithms

Directorate of Technical Education   Karnataka State   CS&E   15CS53T

Time: **3 Hours**   Max Marks**: 100**

PART-A
Answer any <u>SIX</u> questions. Each carries 5 marks.   **5X6=30 Marks**
1. Explain Euclid's algorithm for computing GCD of two numbers.
2. Differentiate undirected and directed graphs with examples.
3. Write a pseudo code for finding the value of the largest element in a list of n numbers.
4. Write a recursive algorithm for computing the factorial function for an arbitrary non-negative integer.
5. Define Brute force and explain it with example.
6. Define binary tree. Explain its traversals.
7. Derive an expression for worst case analysis of binary search algorithm
8. Apply Prim's algorithm for the graph shown below
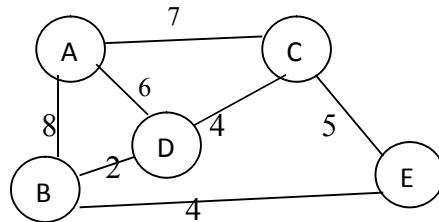
9. Write Greedy algorithm and explain

PART-B
Answer any <u>SEVEN</u> questions. Each carries 10 marks.   **7X10=70 Marks**
1. Explain the steps involved in designing and analysing an algorithm.
2. Write a note on Sorting and Searching problem types.
3. Write an algorithm for sequential search and analyse its worst-case, best-case and average-case efficiencies.
4. Apply selection sort to the following array : 45,23,89,10,11,27,38
5. Explain bubble sort method with an example. Use Brute Force approach.
6. Solve using DFS algorithm
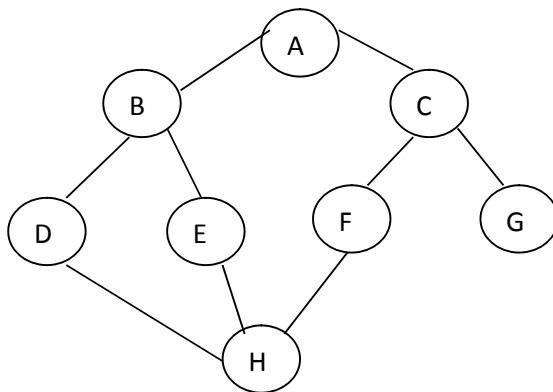
8. Write an algorithm of Quick Sort and trace it for an example data set.
9. Compute time complexity of insertion sort in the best, worst and average cases.
10. Write the Kruskal's algorithm to find the minimum cost spanning tree.

CO	Question	CL	Marks
I	Define Algorithm. Give an example illustrating the notion of an algorithm.	R	05
	Explain Euclid's algorithm for computing GCD of two numbers.	U,A	
	Explain Linear data structures with example.	U	
	Define Graph, Vertex, Edge, Path and Length of a path with example for each.	R	
	Write a note on Weighted graph with an example.	U	
	Give the differences between sets and dictionaries.	R	
	Explain the steps involved in designing and analysing of an algorithm.	U	10
	Write a note on Sorting and Searching problem types.	U	
	Explain Rooted Trees and Ordered Trees with example for each.	U	
II	Write an algorithm for sequential search.	U,A	05
	Write a pseudo code for finding the value of the largest element in a list of n numbers.	U,A	
	Write a recursive algorithm for computing the factorial function for an arbitrary non-negative integer.	U,A	
	Illustrate an algorithm for sequential search and Analyse its worst-case, best-case and average-case efficiencies.	AL	10
	Explain Big-oh notation, Big-omega notation and Big-theta notation along with its graph.	AL	
	Explain basic Asymptotic efficiency classes.	U	
	Illustrate the recursive solution to the Tower of Hanoi Puzzle.	A,AL	
III	Define Brute force and explain it with example.	R,U	5
	Write an algorithm for closest pair problem using brute force.	U,A	
	Illustrate an algorithm for Selection sort with example.	A,AL	10
	Illustrate an algorithm for Bubble sort with example.	A,AL	
	Illustrate Travelling salesman problem with example.	A,AL	
	Explain Breadth First Search algorithm	A,AL	

	Consider knapsack for the instance given below
	    N=3
	 [w1,w2,w3]=[100,10,10]
	 [p1,p2,p3]=[20,15,15]
	    M=105
	Find all feasible and infeasible solutions
		A,AL	

	Explain Depth First Search algorithm	A,AL	
IV	Write an algorithm for binary search.	U,A	5
	Define binary tree. Explain its traversals.	R,U	
	Explain Divide-and-Conquer technique with neat diagram.	U	
	Explain Merge sort algorithm with example.	A,AL	10
	Write Quick Sort algorithm and trace it with an example.	A,AL	
	Analyze the binary search algorithm for best case, worst case and average cases.	AL	
V	Explain Decrease-and-Conquer technique with neat diagram.	U	05
	Explain topological sorting with example.	A	
	Write an algorithm for Insertion sort with example.	A,AL	10
	Compute time complexity of insertion sort in the best, worst and average cases.	AL	
	Explain greedy method with appropriate example	U,A	5

VI	Can the Prim's algorithm be applied for directed graphs? justify	U,A	
	Write the algorithm to find the minimum cost spanning tree based on Prim's logic	A, AL	
	Explain Kruskal's algorithm for constructing a minimum spanning tree.	AL	**10**
	Write Prim's algorithm for constructing a minimum spanning tree	AL	
	Explain Dijkstra algorithm with an example.	AL	