LECTURE PLAN

Institute/Department	UNIVERSITY INSTITUTE OF COMPUTING (UIC)	**Program**	**Master of Computer Applications (MC305)**
Master Subject Coordinator Name:	Maajid Bashir	**Master Subject Coordinator E-Code**:	**E17205**
Course Name	Design and Analysis of Algorithms	**Course Code**	**24CAT-611**

Lecture	Tutorial	Practical	Self Study	Credit	Subject Type
3	0	0	0	3.00	T

Course Type	Course Category	Mode of Assessment	Mode of Delivery
Major Core	Graded (GR)	Theory Examination (ET)	Theory (TH)

Mission of the Department	M1. To provide innovative learning centric facilities and quality-oriented teaching learning process for solving computational problems. M2. To provide a framework through Project Based Learning to support society and industry in promoting a multidisciplinary activity. M3. To develop crystal clear evaluation system and experiential learning mechanism aligned with futuristic technologies and industry. M4. To provide doorway for promoting research, innovation and entrepreneurship skills in collaboration with industry and academia. M5. To undertake societal activities for upliftment of rural/deprived sections of the society.
Vision of the Department	To be a Centre of Excellence for nurturing computer professionals with strong application expertise through experiential learning and research for matching the requirements of industry and society instilling in them the spirit of innovation and entrepreneurship.

Text Books

Sr No	Title of the Book	Author Name	Volume/Edition	Publish Hours	Years
1	Introduction to the Design and Analysis of Algorithms	Anany Levitin	3rd Edition	Pearson Education	2011
2	Algorithm Design	Jon Kleinberg and Éva Tardos	1st Edition	Pearson Education	2015
3	The Design and Analysis of Computer Algorithms	Alfred V. Aho, John E. Hopcroft, Jeffrey D. Ullman	1st Edition	Addison-Wesley	1974

Reference Books

Sr No	Title of the Book	Author Name	Volume/Edition	Publish Hours	Years
1	The Art of Computer Programming, Volume 3: Sorting and Searching	Donald E. Knuth	3rd Edition	Addison-Wesley	1973
2	Algorithm Design Manual	Steven S. Skiena	2nd EditionSp	Springer	2008
3	Introduction to Algorithms	Thomas H. Cormen, Charles E. Leiserson, Ronald L.	4th Edition	MIT Press	2022

Course OutCome	
SrNo	OutCome
CO1	Understand the basics of different data structures to manage the data
CO2	Analyze the asymptotic performance of algorithms through algorithmic complexity of simple, non-recursive programs.
CO3	Understand the fundamentals of data structures
CO4	Apply and Analyse important Algorithmic design paradigms and their applications.
CO5	Implement the major graph algorithms to model engineering problems.

Lecture Plan Preview-Theory

Unit No	LectureNo	ChapterName	Topic	Text/ Reference Books	Pedagogical Tool**	Mapped with CO Numer (s)
1	1	Introduction	Introduction to Algorithms	,T-Algorithm Design,T-Introduction to the Design and,T-The Design and Analysis of Com,R-Algorithm Design Manual,R-Introduction to Algorithms,R-The Art of Computer Programmin	Case Study,PPT,Video Lecture	CO1
1	2	Introduction	Algorithm Specification(pseudocode, flowcharts)	,T-Algorithm Design,T-Introduction to the Design and,T-The Design and Analysis of Com,R-Algorithm Design Manual,R-Introduction to Algorithms,R-The Art of Computer Programmin	Case Study,PPT,Video Lecture	CO1
1	3	Performance Analysis	Analysis Framework	,T-Algorithm Design,T-Introduction to the Design and,T-The Design and Analysis of Com,R-Algorithm Design Manual,R-Introduction to Algorithms,R-The Art of Computer Programmin	Case Study,PPT,Video Lecture	CO1
1	4	Asymptotic Notations	Performance Analysis (Part 1)(Time complexity, Space Complexity)	,T-Algorithm Design,T-Introduction to the Design and,T-The Design and Analysis of Com,R-Algorithm Design Manual,R-Introduction to Algorithms,R-The Art of Computer Programmin	PPT,Video Lecture	CO2
1	5	Asymptotic Notations	Performance Analysis (Part 2)(Space and time complexity for practical algorithms, Tradeoff)	,T-Algorithm Design,T-Introduction to the Design and,T-The Design and Analysis of Com,R-Algorithm Design Manual,R-Introduction to Algorithms,R-The Art of Computer Programmin	PPT,Video Lecture	CO2
1	6	Asymptotic Notations	Asymptotic Notations	,T-Algorithm Design,T-Introduction to the Design and,T-The Design and Analysis of Com,R-Algorithm Design Manual,R-Introduction to Algorithms,R-The Art of Computer Programmin	PPT,Video Lecture	CO2
1	7	Asymptotic Notations	Non-Recursive and Recursive Algorithm Analysis	,T-Algorithm Design,T-Introduction to the Design and,T-The Design and Analysis of Com,R-Algorithm Design Manual,R-Introduction to Algorithms,R-The Art of Computer Programmin	PPT,Video Lecture	CO2

1	8	Searching and Sorting	Searching Algorithms(Linear search, Binary Search)	,T-Algorithm Design,T-Introduction to the Design and,T-The Design and Analysis of Com,R-Algorithm Design Manual,R-Introduction to Algorithms,R-The Art of Computer Programmin	Activity,Case Study,Flipped Classes,Infographics,Instructor Lead WorkShop,PPT,Professor of Practice/Adjunct Faculty/Visiting Professor,Reports,Simulation,Video Lecture	CO3
1	9	Searching and Sorting	Sorting Algorithms (Part 1)(Bubble sort,Merge sort)	,T-Algorithm Design,T-Introduction to the Design and,T-The Design and Analysis of Com,R-Algorithm Design Manual,R-Introduction to Algorithms,R-The Art of Computer Programmin	PPT,Video Lecture	CO1
1	10	Searching and Sorting	Sorting Algorithms (Part 2)(Quick sort: Concept, implementation, and complexity)	,T-Algorithm Design,T-Introduction to the Design and,T-The Design and Analysis of Com,R-Algorithm Design Manual,R-Introduction to Algorithms,R-The Art of Computer Programmin	PPT,Video Lecture	CO4
1	11	Fundamental Data Structures	Linked Lists	,T-Algorithm Design,T-Introduction to the Design and,T-The Design and Analysis of Com,R-Algorithm Design Manual,R-Introduction to Algorithms,R-The Art of Computer Programmin	PPT,Video Lecture	CO3
1	12	Fundamental Data Structures	Stacks and Queues	,T-Algorithm Design,T-Introduction to the Design and,T-The Design and Analysis of Com,R-Algorithm Design Manual,R-Introduction to Algorithms,R-The Art of Computer Programmin	PPT,Video Lecture	CO3
1	13	Fundamental Data Structures	Graphs and Trees(Binary trees and binary search trees)	,T-Algorithm Design,T-Introduction to the Design and,T-The Design and Analysis of Com,R-Algorithm Design Manual,R-Introduction to Algorithms,R-The Art of Computer Programmin	PPT,Video Lecture	CO5
1	14	Fundamental Data Structures	Advanced Trees(AVL trees,B trees)	,T-Algorithm Design,T-Introduction to the Design and,T-The Design and Analysis of Com,R-Algorithm Design Manual,R-Introduction to Algorithms,R-The Art of Computer Programmin	PPT,Video Lecture	CO3
1	15	Fundamental Data Structures	String Matching Algorithms(Rabin-Karp algorithm)	,T-Algorithm Design,T-Introduction to the Design and,T-The Design and Analysis of Com,R-Algorithm Design Manual,R-Introduction to Algorithms,R-The Art of Computer Programmin	PPT,Video Lecture	CO3
2	16	Divide and Conquer	Introduction to Divide and Conquer	,T-Algorithm Design,T-Introduction to the Design and,T-The Design and Analysis of Com,R-Algorithm Design Manual,R-Introduction to Algorithms,R-The Art of Computer Programmin	PPT,Video Lecture	CO4

2	17	Divide and Conquer	Decrease and Conquer	,T-Algorithm Design,T-Introduction to the Design and,T-The Design and Analysis of Com,R-Algorithm Design Manual,R-Introduction to Algorithms,R-The Art of Computer Programmin	PPT,Video Lecture	CO4
2	18	Divide and Conquer	Divide and Conquer vs. Decrease and Conquer	,T-Algorithm Design,T-Introduction to the Design and,T-The Design and Analysis of Com,R-Algorithm Design Manual,R-Introduction to Algorithms,R-The Art of Computer Programmin	PPT,Video Lecture	CO4
2	19	Greedy Method	Introduction to the Greedy Method	,T-Algorithm Design,T-Introduction to the Design and,T-The Design and Analysis of Com,R-Algorithm Design Manual,R-Introduction to Algorithms,R-The Art of Computer Programmin	Activity,Case Study,Flipped Classes,Infographics,Instructor Lead WorkShop,PPT,Professor of Practice/Adjunct Faculty/Visiting Professor,Reports,Simulation,Video Lecture	CO4
2	20	Greedy Method	Fractional Knapsack Problem	,T-Algorithm Design,T-Introduction to the Design and,T-The Design and Analysis of Com,R-Algorithm Design Manual,R-Introduction to Algorithms,R-The Art of Computer Programmin	PPT,Video Lecture	CO4
2	21	Minimum cost Spanning trees	Minimum Cost Spanning Trees (Prim's Algorithm)	,T-Algorithm Design,T-Introduction to the Design and,T-The Design and Analysis of Com,R-Algorithm Design Manual,R-Introduction to Algorithms,R-The Art of Computer Programmin	PPT,Video Lecture	CO4
2	22	Minimum cost Spanning trees	Minimum Cost Spanning Trees (Kruskal's Algorithm)	,T-Algorithm Design,T-Introduction to the Design and,T-The Design and Analysis of Com,R-Algorithm Design Manual,R-Introduction to Algorithms,R-The Art of Computer Programmin	PPT,Video Lecture	CO4
2	23	Shortest paths	Single Source Shortest Paths (Dijkstra's Algorithm)	,T-Algorithm Design,T-Introduction to the Design and,T-The Design and Analysis of Com,R-Algorithm Design Manual,R-Introduction to Algorithms,R-The Art of Computer Programmin	PPT,Video Lecture	CO5
2	24	Optimal Tree Problem	Introduction to Huffman Trees and Codes	,T-Algorithm Design,T-Introduction to the Design and,T-The Design and Analysis of Com,R-Algorithm Design Manual,R-Introduction to Algorithms,R-The Art of Computer Programmin	PPT,Video Lecture	CO5
2	25	Optimal Tree Problem	Huffman Trees and Practical Applications	,T-Algorithm Design,T-Introduction to the Design and,T-The Design and Analysis of Com,R-Algorithm Design Manual,R-Introduction to Algorithms,R-The Art of Computer Programmin	PPT,Video Lecture	CO4

2	26	Transform and Conquer Approach	Transform and Conquer Approach	,T-Algorithm Design,T-Introduction to the Design and,T-The Design and Analysis of Com,R-Algorithm Design Manual,R-Introduction to Algorithms,R-The Art of Computer Programmin	PPT,Video Lecture	CO4
2	27	Transform and Conquer Approach	Heap and Heap Operations	,T-Algorithm Design,T-Introduction to the Design and,T-The Design and Analysis of Com,R-Algorithm Design Manual,R-Introduction to Algorithms,R-The Art of Computer Programmin	PPT,Video Lecture	CO4
2	28	Transform and Conquer Approach	Heap Sort	,T-Algorithm Design,T-Introduction to the Design and,T-The Design and Analysis of Com,R-Algorithm Design Manual,R-Introduction to Algorithms,R-The Art of Computer Programmin	PPT,Video Lecture	CO4
2	29	Transform and Conquer Approach	Advanced Applications of Greedy and Divide & Conquer	,T-Algorithm Design,T-Introduction to the Design and,T-The Design and Analysis of Com,R-Algorithm Design Manual,R-Introduction to Algorithms,R-The Art of Computer Programmin	PPT,Video Lecture	CO4
2	30	Transform and Conquer Approach	Summary and Problem Solving	,T-Algorithm Design,T-Introduction to the Design and,T-The Design and Analysis of Com,R-Algorithm Design Manual,R-Introduction to Algorithms,R-The Art of Computer Programmin	PPT,Video Lecture	CO4
3	31	Dynamic Programming	Introduction to Dynamic Programming	,T-Algorithm Design,T-Introduction to the Design and,T-The Design and Analysis of Com,R-Algorithm Design Manual,R-Introduction to Algorithms,R-The Art of Computer Programmin	PPT,Video Lecture	CO4
3	32	Dynamic Programming	General Method of Dynamic Programming with Examples(DP and Tabulation)	,T-Algorithm Design,T-Introduction to the Design and,T-The Design and Analysis of Com,R-Algorithm Design Manual,R-Introduction to Algorithms,R-The Art of Computer Programmin	PPT,Video Lecture	CO5
3	33	Dynamic Programming	Binomial Coefficient Using Dynamic Programming(Recursive vs DP approach)	,T-Algorithm Design,T-Introduction to the Design and,T-The Design and Analysis of Com,R-Algorithm Design Manual,R-Introduction to Algorithms,R-The Art of Computer Programmin	PPT,Video Lecture	CO5
3	34	Transitive Closure	Warshall's Algorithm for Transitive Closure	,T-Algorithm Design,T-Introduction to the Design and,T-The Design and Analysis of Com,R-Algorithm Design Manual,R-Introduction to Algorithms,R-The Art of Computer Programmin	PPT,Video Lecture	CO5
3	35	Multi Source Shortest Path	Floyd's Algorithm for All-Pairs Shortest Path	,T-Algorithm Design,T-Introduction to the Design and,T-The Design and Analysis of Com,R-Algorithm Design Manual,R-Introduction to Algorithms,R-The Art of Computer Programmin	PPT,Video Lecture	CO5
3	36	Multi Source Shortest Path	Optimal Binary Search Trees	,T-Algorithm Design,T-Introduction to the Design and,T-The Design and Analysis of Com,R-Algorithm Design Manual,R-Introduction to Algorithms,R-The Art of Computer Programmin	PPT,Video Lecture	CO5

3	37	Knapsack Problem	The 0/1 Knapsack Problem	,T-Algorithm Design,T-Introduction to the Design and,T-The Design and Analysis of Com,R-Algorithm Design Manual,R-Introduction to Algorithms,R-The Art of Computer Programmin	PPT,Video Lecture	CO4
3	38	Multi Source Shortest Path	Bellman-Ford Algorithm	,T-Algorithm Design,T-Introduction to the Design and,T-The Design and Analysis of Com,R-Algorithm Design Manual,R-Introduction to Algorithms,R-The Art of Computer Programmin	PPT,Video Lecture	CO5
3	39	Multi Source Shortest Path	Travelling Salesperson Problem (TSP) Using Dynamic Programming	,T-Algorithm Design,T-Introduction to the Design and,T-The Design and Analysis of Com,R-Algorithm Design Manual,R-Introduction to Algorithms,R-The Art of Computer Programmin	PPT,Video Lecture	CO5
3	40	Backtracking: General method	The N-Queens Problem	,T-Algorithm Design,T-Introduction to the Design and,T-The Design and Analysis of Com,R-Algorithm Design Manual,R-Introduction to Algorithms,R-The Art of Computer Programmin	PPT,Video Lecture	CO4
3	41	Backtracking: General method	Sum of Subset Problem	,T-Algorithm Design,T-Introduction to the Design and,T-The Design and Analysis of Com,R-Algorithm Design Manual,R-Introduction to Algorithms,R-The Art of Computer Programmin	PPT,Video Lecture	CO4
3	42	Backtracking: General method	Graph Coloring Problem	,T-Algorithm Design,T-Introduction to the Design and,T-The Design and Analysis of Com,R-Algorithm Design Manual,R-Introduction to Algorithms,R-The Art of Computer Programmin	PPT,Video Lecture	CO4
3	43	Backtracking: General method	Hamiltonian Cycles	,T-Algorithm Design,T-Introduction to the Design and,T-The Design and Analysis of Com,R-Algorithm Design Manual,R-Introduction to Algorithms,R-The Art of Computer Programmin	PPT,Video Lecture	CO4
3	44	Branch and Bound	Branch and Bound Techniques(TSP) using LC (Least-Cost) Branch and Bound.	,T-Algorithm Design,T-Introduction to the Design and,T-The Design and Analysis of Com,R-Algorithm Design Manual,R-Introduction to Algorithms,R-The Art of Computer Programmin	PPT,Video Lecture	CO4
3	45	Types of Complexity Classes	P, NP, CoNP, NP-Hard, and NP-Complete Classes	,T-Algorithm Design,T-Introduction to the Design and,T-The Design and Analysis of Com,R-Algorithm Design Manual,R-Introduction to Algorithms,R-The Art of Computer Programmin	PPT,Video Lecture	CO4

Assessment Model			
Sr No	Assessment Name	Exam Name	Max Marks
1	24TH02	External Theory	60
2	24TH02	Attendance Marks	2
3	24TH02	Mid-Semester Test-1	20
4	24TH02	Surprise Test	12

5	24TH02	Mid-Semester Test-2	20
6	24TH02	Assignment/STP	10
7	24TH02	PBL/Case Study	10
8	24TH02	Quiz/Test	4