LECTURE PLAN

Institute/Department	UNIVERSITY INSTITUTE OF ENGINEERING (UIE)	**Program**	**Bachelor of Engineering - Computer Science & Engineering (CS201)**
Master Subject Coordinator Name:	Priyanka Sharma	**Master Subject Coordinator E-Code**:	**E6197**
Course Name	DESIGN AND ANALYSIS OF ALGORITHMS	**Course Code**	**20CST-311**

Lecture	Tutorial	Practical	Self Study	Credit	Subject Type
3	0	0	0	3.0	T

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

Mission of the Department	MD1: To provide practical knowledge using state-of-the-art technological support for the experiential learning of our students. MD2: To provide an industry-recommended curriculum and transparent assessment for quality learning experiences. MD3: To create global linkages for interdisciplinary collaborative learning and research. MD4: To nurture an advanced learning platform for research and innovation for students' profound future growth. MD5: To inculcate leadership qualities and strong ethical values through value-based education.
Vision of the Department	"To be recognized as a leading Computer Science and Engineering department through effective teaching practices and excellence in research and innovation for creating competent professionals with ethics, values, and entrepreneurial attitude to deliver service to society and to meet the current industry standards at the global level."

Program Educational Objectives(PEOs)	
PEO1	PEO1 Graduates of the Computer Science and Engineering will contribute to the Nation's growth through their ability to solve diverse and complex computer science and engineering problems across a broad range of application areas. (PEO1 is focused on Problem Solving)
PEO2	PEO2 Graduates of the Computer Science and Engineering will be successful professionals, designing and implementing Products & Services of global standards in the field of Computer Science & Engineering, becoming entrepreneurs, Pursuing higher studies & research. (PEO 2 is focused on Professional Success)
PEO3	PEO3 Graduates of the Computer Science and Engineering Program will be able to adapt to changing scenario of dynamic technology with an ability to solve larger societal problems using logical and flexible approach in decision making. (PEO 3 is focused on Attaining Flexibility and Adaptability)

Program Specific OutComes(PSOs)	
PSO1	PSO1 Exhibit attitude for continuous learning and deliver efficient solutions for emerging challenges in the computation domain.
PSO2	PSO2 Apply standard software engineering principles to develop viable solutions for Information Technology Enabled Services (ITES).

Program OutComes(POs)	
PO1	PO1 Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.
PO2	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.
PO3	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.
PO4	PO4 Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of the information to provide valid conclusions.
PO5	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.
PO6	PO6 The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7	PO7 Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development
PO8	PO8 Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	PO9 Individual or teamwork: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	PO10 Communication: Communicate effectively on complex engineering activities with the engineering community and with 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
PO11	PO11 Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	PO12 Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context to technological change.

Text Books

Sr No	Title of the Book	Author Name	Volume/Edition	Publish Hours	Years
1	"Introduction to Algorithms"	Cormen, Leiserson, Rivest, Stein	3rd edition	Prentice Hall of India	2012
2	Fundamentals of ComputerAlgorithms	Horowitz, Sahni and Rajasekaran	2nd edition.	University Press (India)	NA

Reference Books

Sr No	Title of the Book	Author Name	Volume/Edition	Publish Hours	Years
1	"Data Structures using C and C++",	Tanenbaum, Augenstein, &Langsam	NA	Prentice Hall of India.	NA
2	"Fundamentals of Algorithms	Brassard, Bratley	NA	Prentice Hall of India.	NA
3	The Art of Computer Programming	Knuth	Volume 1 Third Edition	NA	NA
4	Data Structures, Schaum's Outline Series	Lipschutz, S	NA	Tata McGraw Hill.	NA
5	Data Structures & Program Design"	Kruse	NA	Prentice Hall of India.	NA
6	, "The Design and analysis of Computer Algorithms",	Aho, Haperoft and Ullman	NA	Pearson Education India.	NA

Course OutCome

SrNo	OutCome
CO1	Apply the knowledge of efficiency evaluation of algorithm with respect to time and space complexity of algorithms.
CO2	Describe the various algorithm development approaches to solve the problems like divide and conquer, graph based, tree based, etc.
CO3	Evaluate the complexity of the algorithms to evaluate the efficiency and effectiveness as greedy strategy, dynamic programming strategy and will able to gain knowledge about backtracking, branch and
CO4	Analyze the various classes for complex problems like P, NP, and NP-Complete and Correlate existing algorithms to improve efficiency.
CO5	Analyze the various techniques for algorithm design and apply the knowledge to solve complex engineering problems.

Lecture Plan Preview-Theory

Unit No	LectureNo	ChapterName	Topic	Text/ Reference Books	Pedagogical Tool**	Mapped with CO Numer (s)
1	1	Algorithms and Program Performance	Designing and analyzing algorithms	,T-“Introduction to Algorithms”,R-“Data Structures using C and C	Video Lecture	CO1
1	2	Algorithms and Program Performance	Time and Space complexity	,T-“Introduction to Algorithms”,R-“Fundamentals of Algorithms	PPT,Video Lecture	CO1
1	3	Algorithms and Program Performance	Average and worst case Analysis	,T-“Introduction to Algorithms”,R-“Fundamentals of Algorithms	PPT,Video Lecture	CO1
1	4	Algorithms and Program Performance	Asymptotic notations	,T-Fundamentals of ComputerAlgori,R-Data Structures, Schaum's Outl	PPT	CO1
1	5	Algorithms and Program Performance	recurrence equations and their solution: substitution method	,T-“Introduction to Algorithms”,R-The Art of Computer Programmin	PPT,Video Lecture	CO1
1	6	Algorithms and Program Performance	recursion-tree method, master method	,T-“Introduction to Algorithms”,R-“Fundamentals of Algorithms	PPT,Video Lecture	CO1
1	7	Review of Data Structures	Arrays, Stacks, Queues	,T-Fundamentals of ComputerAlgori,R-The Art of Computer Programmin	PPT	CO1
1	8	Review of Data Structures	Pointers, Linked Lists (One –way, Two-way and circular Two-way)	,T-Fundamentals of ComputerAlgori,R-“Data Structures using C and C	PPT	CO1
1	9	Review of Data Structures	Hashing, Trees BST	,T-“Introduction to Algorithms”,R-“Fundamentals of Algorithms	PPT	CO2
1	10	Review of Data Structures	B Tree, balanced trees AVL, Red black trees	,T-“Introduction to Algorithms”,R-The Art of Computer Programmin	PPT	CO2
1	11	Review of Data Structures	Heaps, Graphs	,T-“Introduction to Algorithms”,R-The Art of Computer Programmin	PPT	CO2
1	12	Sorting algorithm	Sorting in linear time: counting sort	,T-Fundamentals of ComputerAlgori,R-The Art of Computer Programmin	PPT,Video Lecture	CO2
1	13	Sorting algorithm	radix sort	,T-“Introduction to Algorithms”,R-The Art of Computer Programmin	PPT	CO2
1	14	Sorting algorithm	bucket sort	,T-Fundamentals of ComputerAlgori,R-“Fundamentals of Algorithms	PPT	CO2
1	15	Sorting algorithm	Revision of Unit 1	,T-“Introduction to Algorithms”,R-“Fundamentals of Algorithms	PPT	CO2
2	16	Divide and conquer & Greedy algorithms	Divide and conquer: The General method, Binary search, Finding maximum and minimum of a sequence of numbers	,T-“Introduction to Algorithms”,R-The Art of Computer Programmin	PPT	CO2
2	17	Divide and conquer & Greedy algorithms	2 way Merge sort, Quick sort, Selection sort, Strassen’s matrix multiplication.	,T-“Introduction to Algorithms”,R-“Fundamentals of Algorithms	PPT	CO2
2	18	Divide and conquer & Greedy algorithms	The general method, Fractional Knapsack problem	,T-“Introduction to Algorithms”,R-“Fundamentals of Algorithms	PPT	CO3
2	19	Divide and conquer & Greedy algorithms	Minimum cost spanning tree: Prim’s Algorithm, Kruskal Algorithm;	,T-“Introduction to Algorithms”,R-“Fundamentals of Algorithms	PPT	CO3

2	20	Divide and conquer & Greedy algorithms	Huffman coding, Optimal merge patterns	,T-“Introduction to Algorithms”,R-The Art of Computer Programmin	PPT	CO3
2	21	Dynamic programming	The general method, 0/1 knapsack, Subset Sum problem	,T-“Introduction to Algorithms”,R-“Fundamentals of Algorithms	PPT	CO3
2	22	Dynamic programming	Change making problem, optimal binary search tree, Matrix-chain Multiplication	,T-“Introduction to Algorithms”,R-The Art of Computer Programmin	PPT	CO3
2	23	Dynamic programming	Longest common Subsequence Problem, Travelling salesman problem	,T-“Introduction to Algorithms”,R-The Art of Computer Programmin	PPT	CO3
2	24	Dynamic programming	Comparison of Divide & Conquer and Dynamic Programming techniques	,T-“Introduction to Algorithms”,R-“Fundamentals of Algorithms	PPT	CO3
2	25	Backtracking & Branch and Bound	Backtracking: The general method, N-queen’s problem	,T-“Introduction to Algorithms”,R-The Art of Computer Programmin	PPT	CO3
2	26	Backtracking & Branch and Bound	sum-of-subsets	,T-“Introduction to Algorithms”,T-Fundamentals of ComputerAlgori,R-, ”The Design and analysis of ,R-“Data Structures using C and C,R-“Fundamentals of Algorithms,R-Data Structures & Program Desi,R-Data Structures, Schaum's Outl,R-The Art of Computer Programmin	PPT	CO3
2	27	Backtracking & Branch and Bound	Hamiltonian cycles	,T-“Introduction to Algorithms”,T-Fundamentals of ComputerAlgori,R-, ”The Design and analysis of ,R-“Data Structures using C and C,R-“Fundamentals of Algorithms,R-Data Structures & Program Desi,R-Data Structures, Schaum's Outl,R-The Art of Computer Programmin	PPT	CO3
2	28	Backtracking & Branch and Bound	Branch and Bound: Branch and Bound method, 0/1 Knapsack problem	,T-“Introduction to Algorithms”,T-Fundamentals of ComputerAlgori,R-, ”The Design and analysis of ,R-“Data Structures using C and C,R-“Fundamentals of Algorithms,R-Data Structures & Program Desi,R-Data Structures, Schaum's Outl,R-The Art of Computer Programmin	PPT	CO3
2	29	Backtracking & Branch and Bound	Travelling salesperson problem	,T-“Introduction to Algorithms”,T-Fundamentals of ComputerAlgori,R-, ”The Design and analysis of ,R-“Data Structures using C and C,R-“Fundamentals of Algorithms,R-Data Structures & Program Desi,R-Data Structures, Schaum's Outl,R-The Art of Computer Programmin	PPT	CO3
2	30	Backtracking & Branch and Bound	Revision	,T-“Introduction to Algorithms”,T-Fundamentals of ComputerAlgori,R-, ”The Design and analysis of ,R-“Data Structures using C and C,R-“Fundamentals of Algorithms,R-Data Structures & Program Desi,R-Data Structures, Schaum's Outl,R-The Art of Computer Programmin	PPT	CO3

3	31	Graph Algorithms	Representation of Graphs, Depth First Search, Breadth First search, Topological sort	,T-“Introduction to Algorithms”,T-Fundamentals of ComputerAlgori,R-, ”The Design and analysis of ,R-“Data Structures using C and C,R-“Fundamentals of Algorithms,R-Data Structures & Program Desi,R-Data Structures, Schaum's Outl,R-The Art of Computer Programmin	PPT	CO2
3	32	Graph Algorithms	Single source shortest path: Dijkstra Algorithm & Bellman Ford Algorithm	,T-“Introduction to Algorithms”,T-Fundamentals of ComputerAlgori,R-, ”The Design and analysis of ,R-“Data Structures using C and C,R-“Fundamentals of Algorithms,R-Data Structures & Program Desi,R-Data Structures, Schaum's Outl,R-The Art of Computer Programmin	PPT	CO2
3	33	Graph Algorithms	All-pair shortest paths: Floyd Warshall Algorithm, Minimum Spanning Tree: Sollin’s algorithm	,T-“Introduction to Algorithms”,T-Fundamentals of ComputerAlgori,R-, ”The Design and analysis of ,R-“Data Structures using C and C,R-“Fundamentals of Algorithms,R-Data Structures & Program Desi,R-Data Structures, Schaum's Outl,R-The Art of Computer Programmin	PPT	CO2
3	34	Computational complexity	Basic concepts, P and NP-classes	,T-“Introduction to Algorithms”,T-Fundamentals of ComputerAlgori,R-, ”The Design and analysis of ,R-“Data Structures using C and C,R-“Fundamentals of Algorithms,R-Data Structures & Program Desi,R-Data Structures, Schaum's Outl,R-The Art of Computer Programmin	PPT	CO4
3	35	Computational complexity	proof of NP-hard and NP-completeness.	,T-“Introduction to Algorithms”,T-Fundamentals of ComputerAlgori,R-, ”The Design and analysis of ,R-“Data Structures using C and C,R-“Fundamentals of Algorithms,R-Data Structures & Program Desi,R-Data Structures, Schaum's Outl,R-The Art of Computer Programmin	PPT	CO4
3	36	Miscellaneous topics	Euclid Algorithm for GCD of 2 numbers	,T-“Introduction to Algorithms”,T-Fundamentals of ComputerAlgori,R-, ”The Design and analysis of ,R-“Data Structures using C and C,R-“Fundamentals of Algorithms,R-Data Structures & Program Desi,R-Data Structures, Schaum's Outl,R-The Art of Computer Programmin	PPT	CO1
3	37	Miscellaneous topics	modulo arithmetic	,T-“Introduction to Algorithms”,T-Fundamentals of ComputerAlgori,R-, ”The Design and analysis of ,R-“Data Structures using C and C,R-“Fundamentals of Algorithms,R-Data Structures & Program Desi,R-Data Structures, Schaum's Outl,R-The Art of Computer Programmin	PPT	CO1

3	38	Miscellaneous topics	Chinese remainder theorem	,T-“Introduction to Algorithms”,T-Fundamentals of ComputerAlgori,R-, ”The Design and analysis of ,R-“Data Structures using C and C,R-“Fundamentals of Algorithms,R-Data Structures & Program Desi,R-Data Structures, Schaum's Outl,R-The Art of Computer Programmin	PPT	CO5
3	39	Miscellaneous topics	string manipulation/matching algorithms: Rabin Karp algorithm	,T-“Introduction to Algorithms”,T-Fundamentals of ComputerAlgori,R-, ”The Design and analysis of ,R-“Data Structures using C and C,R-“Fundamentals of Algorithms,R-Data Structures & Program Desi,R-Data Structures, Schaum's Outl,R-The Art of Computer Programmin	Activity,Case Study,Flipped Classes,Infographics,Instructor Lead WorkShop,PPT,Reports,Simulation,Video Lecture	CO5
3	40	Miscellaneous topics	KMP (Knuth-Morris-Pratt) algorithm	,T-“Introduction to Algorithms”,T-Fundamentals of ComputerAlgori,R-, ”The Design and analysis of ,R-“Data Structures using C and C,R-“Fundamentals of Algorithms,R-Data Structures & Program Desi,R-Data Structures, Schaum's Outl,R-The Art of Computer Programmin	PPT	CO5
3	41	Miscellaneous topics	Boyer-Moore algorithm	,T-“Introduction to Algorithms”,T-Fundamentals of ComputerAlgori,R-, ”The Design and analysis of ,R-“Data Structures using C and C,R-“Fundamentals of Algorithms,R-Data Structures & Program Desi,R-Data Structures, Schaum's Outl,R-The Art of Computer Programmin	PPT	CO5
3	42	Miscellaneous topics	Convex Hull.	,T-“Introduction to Algorithms”,T-Fundamentals of ComputerAlgori,R-, ”The Design and analysis of ,R-“Data Structures using C and C,R-“Fundamentals of Algorithms,R-Data Structures & Program Desi,R-Data Structures, Schaum's Outl,R-The Art of Computer Programmin	PPT	CO5
3	43	Divide and conquer & Greedy algorithms	Doubt session 1 : Unit 1	,T-“Introduction to Algorithms”,T-Fundamentals of ComputerAlgori,R-, ”The Design and analysis of ,R-“Data Structures using C and C,R-“Fundamentals of Algorithms,R-Data Structures & Program Desi,R-Data Structures, Schaum's Outl,R-The Art of Computer Programmin	PPT	CO5
3	44	Backtracking & Branch and Bound	Doubt session : Unit 2	,T-“Introduction to Algorithms”,T-Fundamentals of ComputerAlgori,R-, ”The Design and analysis of ,R-“Data Structures using C and C,R-“Fundamentals of Algorithms,R-Data Structures & Program Desi,R-Data Structures, Schaum's Outl,R-The Art of Computer Programmin	PPT	CO5

3	45	Computational complexity	Doubt session : Unit 3	,T-“Introduction to Algorithms”,T-Fundamentals of ComputerAlgori,R-, ”The Design and analysis of ,R-“Data Structures using C and C,R-“Fundamentals of Algorithms,R-Data Structures & Program Desi,R-Data Structures, Schaum's Outl,R-The Art of Computer Programmin	PPT	CO4

Assessment Model			
Sr No	Assessment Name	Exam Name	Max Marks
1	20EU01	External Theory	60
2	20EU01	Assignment	10
3	20EU01	Attendance Marks	2
4	20EU01	Mid-Semester Test-1	40
5	20EU01	Quiz	4
6	20EU01	Surprise Test	12
7	20EU01	Mid-Semester Test-2	40

CO vs PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
CO2	2	3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
CO3	3	3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
CO4	NA	3	2	3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
CO5	NA	2	3	3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Target	2.67	2.75	2.5	3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA