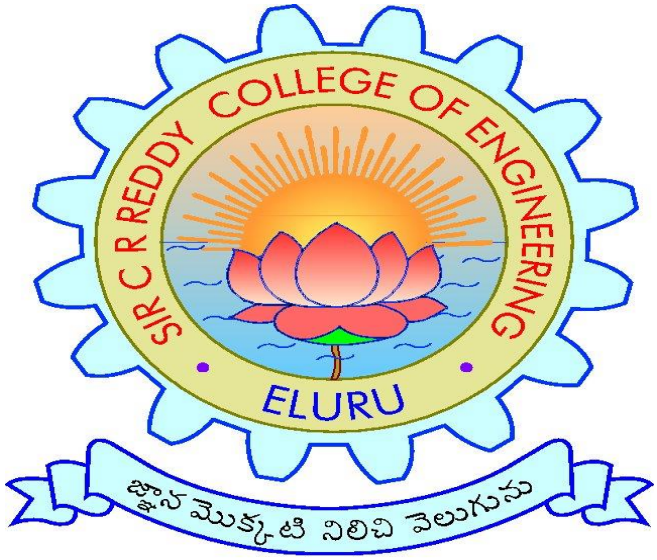
SIR C.R.REDDY COLLEGE OF ENGINEERING, ELURU

DEPARTMENT OF INFORMATION TECHNOLOGY

COURSE HANDOUT



SUBJECT: DESIGN AND ANALYSIS OF ALGORITHMS

CLASS: III/IV B.Tech., I SEMESTER, A.Y.2022-23

INSTRUCTOR: Smt. J.Malathi

Course Handout Index

COLLEGE VISION

To emerge as a premier institution in the field of technical education and research in the state and as a home for holistic development of the students and contribute to the advancement of society and the region.

COLLEGE MISSION

To provide high quality technical education through a creative balance of academic and industry oriented learning; to create an inspiring environment of scholarship and research; to instill high levels of academic and professional discipline; and to establish standards that inculcate ethical and moral values that contribute to growth in career and development of society in general.

VISION OF THE DEPARTMENT

To be a premier Department in the region in the field of Information Technology through academic excellence and research that enable graduates to meet the challenges of industry and society

MISSIONOF THE DEPARTMENT

- To Provide dynamic teaching-learning environment to make the students industry ready and advancement in career;
- To inculcate professional and leadership quality for better employability and entrepreneurship;
- To make high quality professional with moral and ethical values suitable for industry and society

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO1: Solve real world problems through effective professional skills in Information Technology industry and academic research.

PEO2: Analyze and develop applications in Information Technology domain and adapt to changing technology trends with continuous learning.

PEO3: Practice the profession in society with ethical and moral values.

PROGRAM OUTCOMES (POs)

PO1: Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using the first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design/Development of Solutions: Design solutions for complex engineering problems and system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, society, and environmental considerations.

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: 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: 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: Environment and Sustainability: Understand the impact of the professional engineering solutions in society and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multi-disciplinary settings.

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: Project Management and Finance: Demonstrate knowledge and understanding of the

engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multi-disciplinary environments.

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 of technological change.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO1: Design and develop software in the area of relevance under realistic constraints.

PSO2: Adapt new and fast emerging technologies in the field of Information Technology.

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Directorate of Academic Planning
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
KAKINADA-533003, Andhra Pradesh, INDIA
(Established by AP Government Act No. 30 of 2008)

Lr. No. DAP/AC/III Year /B. Tech/B. Pharmacy/2022 *Date 14.07.2022*

Dr. KVSG Murali Krishna,
M.E. Ph.D.,
Director, Academic Planning
JNTUK, Kakinada

To
All the Principals of Affiliated Colleges,
JNTUK, Kakinada.

Academic Calendar for III Year - B. Tech/B. Pharmacy for the AY 2022-23
(2020-21 Admitted Batch)

I SEMESTER			
Description	**From**	**To**	**Weeks**
Community Service Project	**15.07.2022**	30.07.2022	2W
I Unit of Instruction	01.08.2022	24.09.2022	8W
I Mid Examinations	26.09.2022	01.10.2022	1W
II Unit of Instructions	03.10.2022	26.11.2022	8W
II Mid Examinations	28.11.2022	03.12.2022	1W
Preparation & Practicals	05.12.2022	10.12.2022	1W
End Examinations	12.12.2022	25.12.2022	2W

*** As per the APSCHE Guidelines Out of the Total 180 hours of Community Service Project leading to 4 Credits, two weeks will be offline and remaining project work can be done during the III-I semester weekends and holidays.**

KVSG 14.7.22
Director,
Academics & Planning, JNTUK

Director
Academic Planning
JNTUK Kakinada

Copy to the Secretary to the Hon'ble Vice Chancellor, JNTUK
Copy to Rector, Registrar, JNTUK
Copy to Director Academic Audit, JNTUK
Copy to Director of Evaluation, JNTUK

Department Academic Calendar

Department of Information Technology
IV/IV B.Tech Academic Calendar for 2022-23

2022-23	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M
Jul 22						1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	
Aug 22		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31					
Sep 22					1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30			
Oct 22							1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Nov 22			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30					
Dec 22					1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31		
Jan 23	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31						
Feb 23				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28						
Mar 23				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31			
Apr 23							1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
May 23		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31					
Jun 23					1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30			

List of Holidays			
July 10: Bakrid	Oct 9: Maulud Nabi	Mar 22 : Ugadhi	Mid exams
Aug 9:Moharum	Oct 24 : Diwali	Mar 30: Srirama navami	End Examinations
Aug 15:Independence day	Dec 25 :Christmas	Apr 5: Babu Jagjivan Ram Jayanti	Commencement of Class work
Aug 31:Ganesh Chaturdi	Jan 14-16: sankranti	Apr 7: Good friday	Workshops
Oct 2: Gandhi jayanthi	Jan 26:Republic Day	Apr 14:Ambetkar Jayanthi	Department fest/Elite
Oct 5: Vijayadasami	Feb 18 :Sivaratri	Jun 29: Bakrid	HoD
	Mar 8 : holi		Department of IT

Course Description

This is a graduate course surveying topics in DESIGN AND ANALYSIS OF ALGORITHMS. It covers topics in fundamentals of analysis of algorithms and efficiency .It covers advanced topics Divide-and-Conquer, Greedy Technique, Dynamic Programming and Backtracking from the designing of an algorithm viewpoint. It covers NP- Completeness theory ,lower bound theory. This course builds upon the topics covered in undergraduate data structures course, such as Merge sort - Quick sort - Binary Search - Binary Tree Traversals, Depth-First Search and Breadth-First Search. After a brief review, these topics are studied in the context of design and analysis of algorithms.

Course Objectives

Upon completion of this course, students will be able to do the following:

- Ability to understand, analyze and denote time complexities of algorithms
- To introduce the different algorithmic approaches for problem solving through numerous example problems
- Describe the dynamic-programming paradigm and explain when an algorithmic design situation calls for it. Recite algorithms that employ this paradigm. Synthesize dynamic-programming algorithms, and analyze them.

- To provide some theoretical grounding in terms of finding the lower bounds of algorithms and the NP-completeness

Course Outcomes

Students are able to

CO No's	Cos	Level
CO1	Will be able to understand various algorithms approaches to solve engineering problems, asymptotic notation for denoting time complexities of recursive and non-recursive algorithms and theory of NP-completeness.	L2
CO2	Will be able to Apply various techniques like divide and conquer, greedy technique to solve in solve in common engineering design situations.	L3
CO3	Will be able to Apply various algorithm design paradigms like dynamic programming, backtracking to solve problems	L3
CO4	Will be able to Analyze the performance of given algorithm and determine its space and time complexity.	L4

S.No	Unit	Description	Teaching Aids	CO
1	I	Algorithm Definition	BB	CO1
2		Algorithm Specification	BB	CO1
3		Performance Analysis	BB	CO1
4		Performance Measurement	BB	CO1
5		Asymptotic Notation	BB	CO1
6		Asymptotic Notation with examples	BB	CO1
7		Asymptotic Notation with examples	BB/PPT	CO1
8		Randomized Algorithms	PPT	CO1

9	II	Divide and conquer general method, Defective chess board problem	PPT	CO2
10		Binary Search	BB	CO2/CO4
11		Finding the minimum and maximum	BB	CO2/CO4
12		Merge Sort	BB	CO2
13		Merge sort analysis	BB	CO2/CO4
14		Quick sort	BB	CO2
15		Quick sort analysis	BB/PPT	CO2/CO4
16		Greedy method the general method	BB	CO2
17		Knapsack problem	BB	CO2
18		Knapsack problem analysis	BB	CO2/CO4
19		Minimum cost spanning tree	BB	CO2
20		Minimum cost spanning tree	BB/PPT	CO2/CO4
21		Optimal merge patterns	PPT	CO2/CO4
22		Single source shortest paths	BB	CO2
23		Single source shortest paths	BB/PPT	CO2
24	III	The general method of dynamic programming	BB	CO3
25		Multistage graphs	BB	CO3
26		Multistage graphs examples	BB/PPT	CO3
27		All pairs-shortest paths	BB	CO3
28		All pairs-shortest paths examples	BB/PPT	CO3/CO4
29		Optimal binary search trees	BB	CO3
30		Optimal binary search trees	BB/PPT	CO3/CO4
31		0/1 knapsack	BB	CO3
32		0/1 knapsack	BB/PPT	CO3/CO4

33		The travelling salesperson problem	BB	CO3
34	IV	The general method for backtracking	BB	CO3
35		The 4-queens problem	BB	CO3
36		The 8-queens problem	BB/PPT	CO3
37		Sum of subsets	BB	CO3/CO4
38		Graph coloring	BB	CO3/CO4
39		Hamiltonian cycles	BB	CO3/CO4
40		Knapsack problem	BB	CO3/CO4
41	V	Basic concepts of NP-Hard and NP-complete problems	BB/PPT	CO1
42		Non-deterministic algorithms	PPT	CO1
43		Non-deterministic algorithms	PPT	CO1
44		NP-Hard and NP-Complete classes	PPT	CO1
45		Cook's theorem	BB	CO4
Total Classes			45	10

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	**3**	**2**												
CO2	**3**	**2**	**2**									**1**		
CO3	**3**	**2**	**2**									**1**		
CO4	**3**	**3**	**3**	**1**								**1**	**1**	

Evaluation Pattern

S. No	Components	Internal	External	Total
1	Theory	30	70	100
2	Engineering Graphics/Design/Drawing	30	70	100
3	Practical	15	35	50
4	Mini Project/Internship/Industrial Training/ Skill Development programmes/Research Project	-	50	50
5	Project Work	60	140	200

Marks Range Theory (Max – 100)	Marks Range Lab (Max – 50)	Level	Letter Grade	Grade Point
≥ 90	≥ 45	Outstanding	A+	10
≥80 to <89	≥40 to <44	Excellent	A	9
≥70 to <79	≥35 to <39	Very Good	B	8
≥60 to <69	≥30 to <34	Good	C	7
≥50 to <59	≥25 to <29	Fair	D	6
≥40 to <49	≥20 to <24	Satisfactory	E	5
<40	<20	Fail	F	0
-		Absent	AB	0

Day/Time	09.00-09.50	09.50-10.40	11.00-11.50	11.50-12.40	01.40-02.30	02.30-03.20	03.20-04.10	04.10-05.00
Mon	DAA(A)		DAA(B)					
Tue					DAA(B)			
Wed	DAA(B)					DAA(A)		
Thu		DAA(A)			DAA(A)			
Fri		DAA(B)		DAA(A)				
Sat	DAA(B)							

DAA Unit Wise Important Questions:

UNIT-I

1. Define the term algorithm and state the criteria the algorithm should satisfy?
2. Define order of an algorithm and the need to analyze the algorithm?
3. Define asymptotic notations: big 'Oh', omega and theta?
4. Explain about randomized algorithms?

UNIT – II

1. Explain the general method for divide and conquer?
2. Explain about defective chess board problem?
3. Explain about binary search tree and analyze its efficiency?
4. Analyze the best average and worst case complexity for merge sort?
5. Explain quick sort with an example?
6. Define greedy method?
7. Explain knapsack problem with an example?
8. Define minimum cost spanning tree algorithm?
9. Explain about single source shortest path algorithm?
10. Explain about optimal merge patterns?

UNIT – III

1. Explain about general method for dynamic programming?
2. Explain about multistage graphs with examples?
3. Explain about all pairs-shortest paths algorithm and analyze its efficiency?
4. Explain about optimal Binary search trees with examples?
5. Explain about 0/1 knapsack problem with example?
6. Explain about the traveling salesperson problem with example?

UNIT-IV

1. Explain about the General Method for backtracking?
2. Explain about 4-Queens and 8-Queens problem.
3. Explain about sum of subsets and graph coloring problems with suitable examples?
4. Explain about Hamiltonian cycles with example?
5. Explain about knapsack problem using backtracking?

UNIT – V

1. Define class P?
2. Compare NP-hard and NP-completeness?
3. Define NP- hard problem
4. Explain about non deterministic algorithms?
5. Explain about cooks theorem?