Name: **Enrolment No:**	

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, December 2022

Course: Design and Analysis of Algorithms **Semester: III**
Program: B.Tech **Time: 03 hrs.**
Course Code: CSEG 2022 **Max. Marks: 100**

Instructions: All questions of the section A is mandatory. In section B, attempt any one of the Q 9 and Q 10. In section C, attempt either Q 12 or Q 13. Remaining questions from sections B and C are mandatory.

SECTION A
(5Qx4M=20Marks)

S. No.		Marks	CO
Q 1	What is an algorithm and how it is different from a program?	**3+1**	**CO1**
Q 2	Solve the recurrence relation using Master Theorem $T(n) = 4T(n/3) + n^2$	**4**	**CO2**
Q 3	Find the solution to the following recurrence equation $T(n)=T(n/2)+1$ with the base condition as $T(1)=1$	**4**	**CO1**
Q 4	Derive the time complexity of Quick sort algorithm for worst case.	**4**	**CO2**
Q 5	Distinguish between Dynamic Programming and Greedy method.	**4**	**CO3**

SECTION B
(4Qx10M= 40 Marks)

Q 6	What is a Spanning tree? Explain Prim's Minimum cost spanning tree algorithm with suitable example	**2+6+2**	**CO3**
Q 7	Describe asymptotic notations? Illustrate any three notations with diagrams. How the performance can be analyzed with these notations?	**2+8**	**CO1**
Q 8	Explain Activity Selection problem in detail with suitable example?	**10**	**CO2**
Q 9	Explain Task Scheduling Problem with deadline and Penalty. **OR**	**10**	**CO4**
Q 10	Describe the Dynamic 0/1 Knapsack Problem. Find an optimal solution for the dynamic programming 0/1 knapsack instance for n=3, m=6, profits are (p1, p2, p3) = (1,2,5), weights are (w1,w2,w3)=(2,3,4).	**2+8**	**CO4**

SECTION-C
(2Qx20M=40 Marks)

Q 11	Explain Huffman coding with its characteristics. Consider the following characters with their frequencies in a file	**3+8+3+3+3**	**CO3**

	a-10, e-15, i-12, o-3, u-4, s-13, t-1. If Huffman coding is used for data compression, determine i) Create a Huffman tree for the following message ii) Huffman code for each character iii) Average code length iv) Length of Huffman encoded message (in bits)		
Q 12	i) Explain Merge sort with its characteristics ii) Apply merge sort algorithm to arrange the following array of numbers in increasing order 100, 55, 70, 1, 30, 75, 27, 5, 25, 34 iii) Is merge sort a stable sort? iv) Find the time complexities if the algorithm in worst and best cases. **OR**	**4+8+2+6**	**CO3**
Q 13	What is Radix sort and how it is different from the comparison-based sorting? Consider the following keys and apply Radix sorting algorithm to arrange the keys in non-decreasing order 171,290, 111, 144, 97, 836, 414, 189, 212. Find the time complexities in all the three cases.	**5+10+5**	**CO4**