Code No.: R22CS58315OE	R22	H.T.No.			8	R						

CMR ENGINEERING COLLEGE: : HYDERABAD
UGC AUTONOMOUS
II–M.TECH–I–Semester End Examinations (Regular) - January- 2026
OPERATIONS RESEARCH (OE)
(VLSI SD)

[Time: 3 Hours] **[Max. Marks: 60]**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 10 marks. Answer all questions in Part A.
Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

PART-A **(10 Marks)**

1. a) What is degeneracy in simplex method? [1M]
   b) Define slack variable. [1M]
   c) What are Limitations of graphical method? [1M]
   d) What is the purpose of artificial variable? [1M]
   e) State the Kuhn-Tucker conditions [1M]
   f) Explain the Optimistic time. [1M]
   g) Name the algorithm used for solving a sequencing model problem. [1M]
   h) Define "Safety stock" in connection with inventory management. [1M]
   i) Give the meaning of "Principle of optimality" used in dynamic programming. [1M]
   j) What are the Advantages of Game Theory? [1M]

PART-B **(50 Marks)**

2. A firm manufacturers four different machine parts A, B, C and D using copper and zinc. The requirement of copper and zinc for each part and their availability and the profit earned from each part are given below. [10M]

Item	Requirement (kg)		Profit (Rs.)
	Copper	Zinc	
A	5	2	12
B	4	3	8
C	2	8	14
D	1	1	10
availability	100	75	

How many of each part should be manufactured to maximize the profit.

OR

3. Solve the Simplex method [10M]
   Maximize $Z=3X_1+4X_2$
   Subjected to $X_1 - X_2 \leq 1$
   $-X_1+ X_2 \leq 2$
   $X_1, X_2 \geq 0$

4. Use Dual simplex method to solve the following problem: [10M]
Maximize $Z = -2X_1 - 3X_2$
Subject to
$X_1 + X_2 \geq 2$
$2X_1 + X_2 \leq 10$
$X_1 + X_2 \leq 8$
$X_1, X_2 \geq 0$

OR

5. How do you proceed in simplex when [10M]
(i) there is an equality constraint and
ii) When there is an unrestricted variable? What are the advantages and applications of duality? Discuss.

6. Use the Kuhn–Tucker conditions to find the optimal solution to the following Non Linear Problem: [10M]
Min $Z = (x_1 - 1)^2 + (x_2 - 2)^2$
subjected to
$-x_1 + x_2 = 1$
$x_1 + x_2 \leq 2$
$x_1, x_2 \geq 0$

OR

7. Find out the time, variance and standard deviation of the project with the following time estimates in weeks: [10M]

Activity	Optimistic time estimate (to)	Most likely time estimate (tm)	Pessimistic time estimate (tp)
1-2	3	6	9
1-6	2	5	8
2-3	6	12	18
2-4	4	5	6
3-5	8	11	14
4-5	3	7	11
6-7	3	9	15
5-8	2	4	6
7-8	8	16	18

8. Find the sequence that minimizes the total elapsed time (in hours) required to complete the following task on two machine. [10M]

Task	A	B	C	D	E	F	G	H	I
Machine-I	2	5	4	9	6	8	7	5	4
Machine-II	6	8	7	4	3	9	3	8	11

OR

9. Minimize $f = x_1 x_2^2 x_3^{-1} + 2x_1^{-1} x_2^{-3} x_4 + 10 x_1 x_3$ [10M]
Subjected to
$3x_1^{-1} x_3^{-2} x_4^{-2} + 4x_3 x_4 \leq 1$
$5 x_1 x_2 \leq 1$ solve by Geometric programming method.

10. Apply the dynamic programming to solve the following problem. [10M]
Minimize $f(y) = x_1^2 + x_2^2 + x_3^2$
$x_1 + x_2 + x_3 \geq 12$
$x_1, x_2, x_3 \geq 0$

OR

11. Solve the game whose payoff matrix is given. [10M]

	I	II	III	IV
I	3	2	4	0
II	3	4	2	4
III	4	2	4	0
IV	0	4	0	8

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