Code No.: MAZ01OE | R20 | H.T.No. | | | 8 | R | | | | | |

CMR ENGINEERING COLLEGE: : HYDERABAD
UGC AUTONOMOUS
II–M.TECH–I–Semester End Examinations (Regular) - Feb- 2023
OPERATIONS RESEARCH (OE)
(Common for VLSI SD & CSE)

[Time: 3 Hours] **[Max. Marks: 70]**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 20 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 **(20 Marks)**

1. a) Write the classification of OR models. [2M]
   b) Discuss about types of inventory control models. [2M]
   c) Give the applications of duality theory. [2M]
   d) What are the steps to solution of a LP problem by graphical method? [2M]
   e) Differentiate between CPM Network and PERT Network. [2M]
   f) What are the Kuhn-Tucker necessary conditions for a minimum and a maximum? [2M]
   g) What is sequencing problem? State the assumptions of it. Give an example. [2M]
   h) What is geometric programming problem? [2M]
   i) How is graph theory used in operations research? [2M]
   j) State the applications of dynamic programming. [2M]

PART-B **(50 Marks)**

2. A factory manufactures three products, which require three resources – labour, material and administration. The unit profits on these products are Rs. 100, Rs. 60, and Rs. 40 respectively. There are 100 hr of labour, 600 kg of material and 300 hr of administration available per day. The resource requirements for the products to manufacture are given in the table below. [10M]

Resource	Product 1	Product 2	Product 3
Labour	1	1	1
Material	10	4	5
Administration	2	2	6

Determine the optimal product mix and do sensitivity analysis.

OR

3. Solve the following LPP by using simplex method; [10M]

Max Z = $6x_1 + 4x_2$

Subject to

$x_1 + 2x_2 \leq 720$

$2x_1 + x_2 \leq 780$

$x_1 \leq 320$

4. Find solution using dual-simplex method [10M]

MAX $Z = -2x_1 - x_2$

subject to

$-3x_1 - x_2 \leq -3$

$-4x_1 - 3x_2 \leq -6$

$-x_1 - 2x_2 \leq -3$

and $x_1, x_2 \geq 0$

OR

5. A paper mill produces 2 grades of paper namely x and y. Because of raw material restrictions, it cannot produce more than 400 tonnes of grade x and 300 tonnes of grade y in a week. There are 160 production hours in a week. It requires 0.2 hours and 1.4 hours to produce a tone of product x and y respectively, with corresponding profits of Rs.200 and Rs.500 per ton. Formulate the above LPP to maximize the profit using the graphical method. [10M]

6. Find the maximum of [10M]

$$f(x, y) = -(x - 5)^2 - (y - 5)^2$$

subject to

$x^2 + y \leq 9,$

$x, y \geq 0$

OR

7. Draw network and identify critical path for the following data: [10M]

Activity	1-2	2-3	2-4	2-5	3-5	3-6	4-5	4-6	5-6
Time (Days)	5	3	1	6	2	2	3	4	5

8. There are nine jobs, each of which must go through two machines P and Q in the order PQ, the processing times (in hours) are given below: [10M]

Machine	Job(s)								
	A	B	C	D	E	F	G	H	I
P	2	5	4	9	6	8	7	5	4
Q	6	8	7	4	3	9	3	8	11

Find the sequence that minimizes the total elapsed time T. Also calculate the total idle time for the machines in this period.

OR

9. A manufacturer uses Rs.20, 000 worth of an item during the year. Manufacturer estimated the ordering cost as Rs.50 per order and holding costs as 12.5% of average inventory value. Find the optimal order size, number of orders per year, time period per order and total cost. [10M]

10. A manufacturing company processes 6 different jobs on two machines A and B. Number of units of each job and its processing times on A and B are given below. Find the optimal sequence, the total minimum elapsed time and idle time for either machine. [10M]

Job Number	Number of units of each job	Processing Time (in Minutes)	
		Machine A	Machine B
1	3	5	8
2	4	16	7
3	2	6	11
4	5	3	5
5	2	9	7.5
6	3	6	14

OR

11. Use dynamic programming to solve the following LP problem: [10M]

Maximize: $z = 3x_1 + 4x_2$

Subject to: $2x_1 + x_2 \leq 40$

$2x_1 + 5x_2 \leq 180$

and $x_1, x_2 \geq 0$

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