BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS: IMSC. **SEMESTER : VIII**
BRANCH: MATHS & COMP. **SESSION : SP/2023**

SUBJECT: MA414 ADVANCED OPERATION RESEARCH

TIME: 3 Hours **FULL MARKS: 50**

INSTRUCTIONS:
1. The question paper contains 5 questions each of 10 marks and total 50 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
***4*. Before attempting the question paper, be sure that you have got the correct question paper.**
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

			CO	BL
Q.1(a)	A 4-ton vessel can be loaded with one or more of three items. The following table gives the unit weight w_i in tons and the unit revenue in thousands of rupees r_i, for item i. Using Dynamic Programming find how should the vessel be loaded to maximize the total return?	[5]	1	3

Item i	w_i	r_i
1	1	30
2	2	60
3	3	80

Q.1(b) Use dynamic programming to solve the following LPP [5] 1 2

$$Maximize\ Z = 3x_1 + 5x_2$$

Subject to

$$x_1 \leq 4;\ x_2 \leq 6;\ 3x_1 + 2x_2 \leq 18;\ x_1, x_2 \geq 0$$

Q.2(a) A stockist has to supply 12,000 units of a product per year to his customer. The demand is fixed and known and the shortage cost is assumed is to be infinite. The inventory holding cost is ₹ 0.20 per unit per month and the ordering cost per order is ₹ 350, Determine [5] 2 2

(a) The optimum lot size q_0
(b) optimum scheduling period t_0
(c) Minimum total variable yearly cost.

Q.2(b) A machine shop produces three products l, 2 and 3 in lots. The shop has a warehouse whose total floor area is 4,000 sq. metres. The relevant data for the three items is given below: [5] 2 3

Item	1	2	3
Annual demand (units/year)	500	40	600
Cost/unit (₹)	30	20	70
Setup cost/lot (₹)	800	600	1000
Floor area requited (sq. metres)	5	4	10

Inventory carrying rate is 20% per annum. Determine approximately the economic lot size for each item.

PTO

Q.3(a) You have the chance to play the following game in a gambling casino. A fair die is rolled twice, leading to four outcomes: (l) both rolls show an even match, (2) both rolls show and odd match, (3) the outcomes are either even-odd or odd-even, and (4) all other outcomes. You are allowed to bet your money on exactly two outcomes with equal dollar amounts. For example, you can bet equal dollars on even match (outcome l) and odd match (outcome 2). The payoff for each dollar you bet is $2.00 for the first outcome, $1.95 for the second and the third outcomes, and $1.50 for the fourth outcome. [5] 3 3

(a) Draw the decision tree for the game,

(b) Which two choices would you make?

(c) Do you ever come out ahead in this game?

Q.3(b) Solve the following game graphically [5] 3 2

Player B

Player A	B_1	B_2
A_1	1	−3
A_2	3	5
A_3	−1	6
A_4	4	1
A_5	2	2
A_6	−3	0

Q.4(a) A child care shop dealing with children's requirements has one cashier who handles all customers' payments. The cashier takes on an average 4 minutes per customer. Customers come to cashier's area in random manner but on an average of 10 people per hour. The management received a large number of customers' complaints and decided to investigate the following questions: [5] 4 2

(a) What is the average length of the waiting line to be expected under the existing conditions?

(b) What portion of his time is the cashier expected to be idle?

(c) What is the average length of time that a customer would be expected to wait to pay for his purchase?

(d) If it was decided that a customer would not tolerate a wait of more than 12 minutes, what is the probability that a customer would have to wait at least that length of time?

Q.4(b) Customers arrive at one-window drive according to a Poisson distribution with mean of 10 minutes. Service time per customer is exponential with mean of 6 minutes. The space in front of the window can accommodate only three vehicles including the serviced one. Other vehicles have to wait outside this space. Calculate the [5] 4 3

(a) Probability that an arriving customer can drive directly to the space in front of the window.

(b) Probability that an arriving customer will have to wait outside the directed space.

(c) How long an arriving customer is expected to wait before getting the service?

Q.5(a) Use four iterations of the golden section search method to maximize the function $f(x) = 10 + x^3 - 2x - 5e^{0.1x}$ in the interval $(-5, 5)$ [5] 5 2

Q.5(b) Use Kuhn-Tucker conditions to solve the following NLPP [5] 5 3

$$Maximize\ Z = 2{x_1}^2 + 12x_1x_2 - 7{x_2}^2$$

Subject to

$$2x_1 + 5x_2 \leq 98;\ x_1, x_2 \geq 0$$

::::::27/04/2023::::::E