MMDSE-4.5

Sl.No. :

Total No. of Pages : 3

Fourth Semester M.Sc. Degree Examination, May - 2026

(SLM Scheme) (CBCS)

MATHEMATICS

Operation Research

Time : 3 Hours **Max. Marks : 80**

Instructions : 1) Answer any five questions.

2) All questions carry equal marks.

Q1) a) Describe the guidelines on formulation of LPP Models. **[6]**

b) Formulate the LPP: A company owns two flourmills A & B which have different production capabilities for high medium and low-grade flour, This company has constraint per week with 12, 8 and 24 Kg of high, medium, and low grade flour respectively. It costs the company Rs. 1000 and Rs. 800 per day to run mill A and B respectively. On a day, mill A produces 6,2 and 4 Kgs of high, medium and low grade flour respectively, mill B produces 2, 2 and 12 Kgs of high, medium and low grade flour respectively. How many days per week should each mill be operated in order to meet the contract order most economically? **[6]**

c) What are Slack and Surplus variables in a Linear Programming problem? Give examples. **[4]**

Q2) a) Write the steps involved in solving LPP using Big-M method. Briefly explain the technical terms used. **[6]**

b) Solve by revised simplex method : Max $Z = x_1 + 2x_2$.

Subject to constraints : $x_1 + x_2 \leq 3$; $x_1 + 2x_2 \leq 5$, $3x_1 + x_2 \leq 6$ and $x_1, x_2 \geq 0$. **[10]**

Q3) a) If either the primal or the dual problem has a finite optimal solution, then prove that the other one also possess the same, and hence show that the optimal values of the objective functions of the two problems are equal. **[6]**

b) A small wooden furniture manufacturer has specialized in two types of furniture : Executive Chairs and Executive Tables, both requiring two types of raw materials. An executive chair requires 6 units and 7 units of first and the second kind of raw material while an executive table requires 14 units and 7 units of first and second kind of raw material. In a day, the manufacturer has a supply of 42 units and 35 units of the two types of raw material. Profitability analysis indicate that every unit of chair contributes Rs. 100 while a table contributes Rs. 160. The manufactuer would like to determine the optimum number of chairs and tables to be manufactured in a day to maximize total profits. Formulate integer programming problem and solve by graphical method. **[10]**

Q4) a) Solve the following Integer LP problem using Gomory's cutting plane method:

$$\text{Max : } Z = x_1 + x_2$$

Subjected to constraints : $3x_1 + 2x_2 \leq 5$, $x_2 \leq 2$, and $x_1, x_2 \geq 0$. **[12]**

b) Describe the characteristics of Game Theory. **[4]**

Q5) a) What are loops in a transportation problem? Show that every loop in a transportation problem has even number of cells. **[6]**

b) Write the algorithm of Column Minima Method. Determine IBFS to the following Transportation problem using the method. **[10]**

	d_1	d_2	d_3	Availability
O_1	16	19	12	14
O_2	22	13	19	16
O_3	14	28	8	12
Requirements	10	15	17	

Q6) a) Describe the steps involved in transportation algorithm of MODI method to find the Optimal solution for the given Transportation problem. Write the flow chart. **[10]**

b) Consider problem of assigning 5 jobs to five persons, the assignment cost are as given below. Determine the optimum assignment schedule. **[6]**

	Persons	1	2	3	4	5
Jobs	A	7	3	0	5	0
	B	0	9	4	5	4
	C	1	6	6	0	4
	D	4	3	0	0	3
	E	4	0	2	4	0

Q7) a) Write the Properties of Poisson Process of Arrivals. **[6]**

b) Describe the classifications of queuing models. **[6]**

c) At what average rate must a clerk at a supermarket work in order to ensure a probability of 0.90 that the customer will not have to wait larger than 12 minutes? it is assumed that there is only one customer to which customer arrive in a poison fashion at an average rate of 15 per hour. The length of service by the clerk has an exponential distribution. **[4]**

Q8) a) Use the Wolfe's method to solve the quadratic programming problem: **[12]**

Maximize $Z = 2x_1 + x_2 - x_1^2$

Subject to the constraints :

i) $2x_1 + 3x_2 \leq 6$,

ii) $2x_1 + x_2 \leq 4$ and $x_1, x_2 \geq 0$

b) Describe the importance of Optimal policy in the multi-stage decision processes. **[4]**

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