

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

CLASS: IMSc.
BRANCH: MATHS & COMP.

SEMESTER : VI
SESSION : SP/2023

SUBJECT: MA309 OPTIMIZATION TECHNIQUES

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.

- Q.1(a) A diet for a sick person must contain at least 4000 units of vitamins, 50 units of minerals and 1400 calories. Two foods A and B are available at a cost of Rs. 4 and Rs.3 per unit, respectively. If one unit of A contains 200 units of vitamins, 1 unit of mineral and 40 calories and one unit of food B contains 100 units of vitamins, 2 units of minerals and 40 calories, find by graphic method what combination of foods be used to have least cost? [5] CO 1 BL Moderate
- Q.1(b) Solve by BIG M-Method the following LPP [5] CO 1 BL Moderate
 Minimize $Z=600x+500y$
 Subject to:
 $2x+y \geq 80$
 $x+2y \geq 60$
 and $x, y \geq 0$

- Q.2(a) Four factories, A, B, C and D produce sugar and the capacity of each factory is given below: Factory A produces 10 tons of sugar and B produces 8 tons of sugar, C produces 5 tons of sugar and that of D is 6 tons of sugar. The sugar has demand in three markets X, Y and Z. The demand of market X is 7 tons, that of market Y is 12 tons and the demand of market Z is 4 tons. The following matrix gives the transportation cost of 1 ton of sugar from each factory to the destinations. Find the Optimal Solution for least cost transportation cost by Vogel approximation method. [5] CO 2 BL Moderate

Factories	Cost in Rs. per ton (× 100)			AVAILABILITY IN TONS
	Markets			
	X	Y	Z	
A	4	3	2	10
B	5	6	1	8
C	6	4	3	5
D	3	5	4	6
Requirement in tons	7	12	4	

- Q.2(b) Find the optimal solution for the assignment problem with the following cost matrix: [5] CO 2 BL Moderate

Marketing	Division			
Executive	N	E	W	S
A	14	20	11	19
B	12	10	15	9
C	16	19	18	15
D	17	13	15	14

- Q.3 Solve the following ILPP by cutting plane method. [10] CO 3 BL Moderate
 Max $Z=x + y$
 Subject to:
 $3x+2y \leq 5$
 $y \leq 2$
 $x, y \geq 0$ and are integers

PTO

Q.4(a) A company had planned its operations as follows: [5] 4 Moderate

Activity	1-2	2-4	1-3	3-4	1-4	2-5	4-7	3-6	5-7	6-8	7-8
Duration (Days)	7	8	8	6	6	16	19	24	9	7	8

Draw the network and find the critical paths.

Q.4(b) An engineering project has the following activities, whose time estimates are listed below: [5] 4 Moderate

Activity	optimistic	Most Likely	Pessimistic
1-2	2	2	14
1-3	2	8	14
1-4	4	4	16
2-5	2	2	2
3-5	4	10	28
4-6	4	10	16
5-6	6	12	30

Draw the project network, find critical path, find the expected duration and variance for each activity.

Q.5(a) There are seven jobs, each of which has to go through the machines A and B in the order AB. [5] 5 Moderate

Processing times in hours are as follows:

JOB	1	2	3	4	5	6	7
MACHINE A	3	12	15	6	10	11	9
MACHINE B	8	10	10	6	12	1	3

Determine a sequence of these jobs that will minimize the total elapsed time T. Also find T and idle time for machines A and B.

Q.5(b) A machine operator has to perform three operations, namely plane turning, step turning and taper turning on a number of different jobs. The time required to perform these operations in minutes for each operating for each job is given in the matrix given below. Find the optimal sequence, which minimizes the time required. [5] 5 Moderate

Job	Time for plane Turning In minutes	Time for step turning In minutes	Time for taper turning. In minutes in minutes
1	3	8	13
2	12	6	14
3	5	4	9
4	2	6	12
5	9	3	8
6	11	1	13