

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

**CLASS: MBA
BRANCH: MBA**

**SEMESTER : II
SESSION : SP/2025**

SUBJECT: MT412 OPERATIONS 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.
-

Q.1 Consider the following LP problem, CO BL
[10] 1 3
Minimize $Z = X_1 - X_2$
Subjected to,
 $X_1 + X_2 \geq 2$
 $X_1 + 2X_2 \leq 8$
 $X_1 \geq 0, X_2 \geq 0$

(i) Use GRAPHICAL METHOD to find the optimum solution for Z

(ii) In the above problem if the Objective function is changed to,
Maximize $Z' = X_1 + X_2$
then find the optimum solution for Z'

Q.2 Consider the Primal, [10] 2 4
Maximize $Z = 7X_1 + X_2$.
Subjected to,
 $X_1 + X_2 \leq 3$
 $X_1 + X_2 \geq 2$
 $X_1 \geq 0, X_2 \geq 0$

- (i) Find optimal solution of the primal WITHOUT USING artificial variable.
- (ii) Formulate its Dual. Find the optimal solution of the Dual WITHOUT explicitly solving it.

Q.3 (i) For the Primal problem given in Q.2, identify the upper and lower bounds of the coefficient of variable X_1 , beyond which the optimal solution may change. [10] 3 4

(ii) Consider the 4x4 assignment problem given below,
Apply Hungarian method to find the Optimum Solution and Minimum cost

20	17	22	16
32	29	33	26
26	27	29	28
40	30	35	37

PTO

- Q.4 For the following Transportation Problem use Vogel's Approximation Method to get the Initial Basic Feasible Solution and then use (i)MODI's method to optimize the cost of transportation. [10] 3 4
(ii)Is there an alternate optimum solution? If yes, then find that alternate optimum.

	D1	D2	D3	D4	Supply ▼
S1	2	3	1	4	20
S2	3	1	2	5	30
S3	4	2	3	1	25
Demand ►	25	10	15	25	

- Q.5(a) Find the value of the game for the following payoff matrix of A [5] 3

	B1	B2	B3
A1	3	6	1
A2	5	2	3
A3	4	2	-5

- Q.5(b) Patients arrive at a clinic at the rate of 8/hour (Poisson arrival) and the doctor can treat 72 patients in a day of 8 working hours/day (exponential service). [5] 4 4
(i) What is the probability that a patient doesn't have to wait and can directly go to the doctor's room
(ii) What is the probability that there is no queue?
(iii) What is the expected length of the system?
(iv) What is the expected waiting time in the queue?
(v) What is the probability that there 10 patients in the system?

:::::28/04/2025:::::E