



Programme: ABM
Subject: Operation Research
Subject Code: 11.558
Enrollment No: _____

Full Marks: 70
Time: 3 Hrs.

Section I

1. Short Answer type questions. Answer any four. 4 x 5 = 20

- Define slack and surplus. Explain the purpose of these variables.
- Brief about the three methods by which transportation problems can be solved.
- Define (i) Pure Strategy, (ii) Mixed Strategy, (iii) Saddle Point, (iv) Zero sum game
- Describe game theory problems in brief.
- Explain Economic Order Quantity (EOQ) model with static demand.
- Explain Project Evaluation and Review Technique (PERT).

Section II

Long Answer type questions. Answer any three. 3 x 10 = 30

2. A company is in the process of preparing a budget for launching a new product. The following table provides the associated activities and their duration.

Name of activity	Description of activity	Predecessor(s)	Duration (days)
A	Forecast sales volume	--	10
B	Study comparative market	--	7
C	Design items and facilities	A	5
D	Prepare production schedule	C	3
E	Estimate cost of production	D	2
F	Set sales price	B,E	1
G	Prepare budget	E,F	14

Prepare a project network diagram.

3. There are four warehouses and three market places from where demands are received. The warehouse capacities and market demands are for a given month are given. The transportation costs (in rupees) per unit from warehouses to demand canters are also given below.

	D1	D2	D3	D4	Warehouse Capacity
W1	11	13	17	14	250
W2	16	18	14	10	300
W3	21	24	13	10	400
Total Demands	200	225	275	250	

Using above data, find minimum transportation cost using North-West method. Write the optimal allocation of number of units transported.

4. Table below shows pay-off matrix with respect to player A. Reduce pay off matrix using dominance property and find saddle point, value of the game, probability of optimum strategy of the players.

	Player B, Strategy1	Player B, Strategy2	Player B, Strategy3	Player B, Strategy4	Player B, Strategy5
Player A, Strategy1	54	28	29	30	37
Player A, Strategy2	37	16	25	28	33
Player A, Strategy3	78	39	51	40	46
Player A, Strategy4	11	12	48	23	27

5. Discuss Scope and Applications of Operation Research in managerial decision making.

6. Use Big M method to solve

$$\text{Max } Z = 2x_1 + x_2 + 3x_3, \quad x_1 + x_2 + 2x_3 \leq 5, \quad 2x_1 + 3x_2 + 4x_3 = 12, \quad x_1, x_2, x_3 \geq 0$$

Section III

Application based questions. Answer any one.

1 x 20 = 20

7. Data of ABC Auto Ltd. , a car manufacturing company are given below.

Distance (in km.) chart between Plants and Distribution centers of ABC Auto Ltd.

	Distribution center-1	Distribution center-2
Plant-1	1400	4300
Plant-2	1600	1850
Plant-3	1650	1100

Cost of transportation per car per km. is Rs. 8

Chart for total production per plant and total demand per distribution center.

	Distribution center-1	Distribution center-2	Total production
Plant-1			800
Plant-2			1200
Plant-3			1000
Total Demand =>	1900	1100	

Questions:

- Write the “transportation cost table” (transportation cost of one car from a plant to a distribution center. (4 marks).
- Write all linear equations and constraints related to above problem. (4 marks)
- Write linear equation for total cost of transportation of all cars from Plants to Distribution Centers. (1 mark)
- Find optimal solution (values of x_{ij}) for minimum total cost of transportation. (7 marks)
- Calculate minimum total cost of transportation. (4 marks)

8. Table below shows pay-off matrix with respect to player A. Find value of the game, probability of optimum strategy of the players.

	Player B, Strategy1	Player B, Strategy2	Player B, Strategy3	Player B, Strategy4
Player A, Strategy1	2	2	3	-1
Player A, Strategy2	4	3	2	6

9. A publisher has a contract with an author to publish a book. The associated activities are given below. The author is required to submit hard copy and a soft copy of the manuscript. Prepare a project network diagram. Evaluate the earliest start time and latest completion time at each node of the network. Find the critical path and duration to complete the project.

Name of activity	Description of activity	Predecessor(s)	Duration (Weeks)
A	Manuscript proofreading by editor	--	3
B	Sample pages preparation	--	2
C	Book cover design	--	4
D	Artwork preparation	--	3
E	Author’s approval of manuscript and sample pages	A,B	2
F	Book formatting	E	4
G	Author’s review of formatted pages	F	2
H	Author’s review of artwork	D	1
I	Production of printing plates	G,H	2
J	Book production and binding	C,I	4
