

USN

Course Code M B A 2 0 4

Second Semester MBA Degree Examinations, August 2026

OPERATIONS RESEARCH

Duration: 3 hrs

Max. Marks: 100

- Note:**
1. Answer any FOUR full questions from Question No. 1 to 7.
 2. Question No. 8 is compulsory
 3. Missing data, if any, may be suitably assumed

<u>Q. No</u>	<u>Question</u>	<u>Marks</u>	<u>(RBTL:CO:PO)</u>
1	a. Interpret the definition of Operations Research (OR) for real-world problems.	03	(3: 1: 1)
	b. Investigate the characteristics and limitations of Operation Research in business.	07	(3: 1: 1)
	c. Evaluate the extensive application of OR Models in solving business problems.	10	(3: 1: 1)
2	a. Illustrate the application of LPP in various fields of management.	03	(4: 2: 2)
	b. Sanjeevani Company makes two different type of food stuffs F1 and F2, each containing different proportions of vitamins X and Y. F1 contains three units of vitamin X and two units of vitamin Y. Similarly, F2 contains four units of vitamin X and one and half units of vitamin Y. Cost of one unit of F1 is Rs.3.50 and that of F2 is Rs.5. Minimum daily requirement for a person of these vitamins are 30 units of X and 40 units of Y. Assume that excess of daily requirement of vitamins is harmless. Analyse and formulate LPP with the optimal mixture of food stuffs at the minimum cost.	07	(4: 2: 2)
	c. A manufacturer produces two models A and B of a product. Details related to them are furnished in below:	10	(4: 2: 2)

	Model-A	Model-B	Requirement
Number of Units	X	Y	
Profit (Rs.)	300	400	Maximize
Grinding Time (Hrs.)	4	2	≤ 80
Polishing Time (Hrs.)	2	5	≤ 180

Evaluate and solve the LPP graphically.

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|---|---|----|-----------|
| 3 | a. Exemplify application of simulation techniques in areas of business management. | 03 | (5: 2: 2) |
| | b. A fashion designer had carried out an extensive market survey on her alternative strategies and furnished the following related payoffs in different likely demands with their probability distribution. | 07 | (5: 2: 2) |

Strategies	States of Nature of Demand		
	High	Moderate	Low
Payoffs (Rs. in Lakhs)			
Maxi Skirts	5.00	3.20	(1.00)
Midi Skirts	7.50	3.00	(2.00)
Mini Skirts	4.00	1.50	(1.25)
Probability Distribution			
Probability	0.60	0.30	0.10

Note: (RBTL - Revised Bloom's Taxonomy Level: CO - Course Outcome: PO – Programme Outcome)

Analyse and compute expected monetary value (expected payoffs) for each alternative. Suggest which strategy to be opt to maximize the profits.

- c. An automobile company manufactures electric scooters and the daily production varies from 146 to 154 depending upon the availability of raw materials and manpower. 10 (5: 2: 2)

Production (per day)	146	147	148	149	150	151	152	153	154
Probability	0.04	0.09	0.12	0.14	0.11	0.10	0.20	0.12	0.08

The finished scooters are transported in a specially arranged lorry accommodating 150 scooters in a trip. Using the random numbers 80, 81, 76, 75 and 64 simulate the process using Monte Carlo Technique to determine: (i) Average number of scooters waiting in the factory.

(ii) Average number of empty spaces on the lorry.

4. a. Examine the differences between transportation and assignment problems. 03 (3: 3: 3)
 b. Zuari Fertilisers and Chemicals Limited has three warehouses at Mangaluru, Davanagere and Kalaburagi which are having surplus of 50, 60 and 40 tonnes of fertilizers respectively. It has four distribution centres at Bengaluru, Hubballi, Ballari and Mysuru which needed 30, 80, 50 and 10 tonnes of fertilizers respectively. The cost of shipping one tonnes, rupees in lakhs, are as follows: 07 (4: 3: 3)

	Bengaluru	Hubballi	Ballari	Mysuru
Mangaluru	50	150	70	60
Davanagere	80	70	90	10
Kalaburagi	15	87	79	81

Analyse and schedule the transportation to minimize the transportation cost using NWCR method.

- c. L&T Construction Company needs 3, 3, 4 and 5 million cubic feet of fill of four earthen dam sites A, B, C and D in Karnataka respectively. It can transfer the fill from three mounds X, Y and Z where 2, 6 and 7 million cubic feet of fill is available respectively. Costs of transportation one million cubic feet of fill from mounds to the four sites in lakhs are given in the following table. 10 (5: 3: 3)

	A	B	C	D
X	15	10	17	18
Y	16	13	12	13
Z	12	17	20	11

Evaluate and determine the optimum transportation plan using VAM, which minimizes the total transportation cost to the company by applying MODI method.

5. a. Analyse mini-max and maxi-mini of a game. 03 (4: 4: 4)
 b. An employee's union of KSRTC is negotiating with Government of Karnataka a new 5-year settlement regarding payments. Options the union has are: X-Aggressive Bargaining, Y-Bargaining with Reasoning, and Z-Conciliatory Approach. Similarly, the likely mode of response from Government are: P-Aggressive Bargaining, Q-Bargaining with Reasoning, R-Legalistic Approach and S-Conciliatory Approach. The gains to the union in each case are as follows: 07 (4: 4: 4)

	P	Q	R	S
X	20	15	12	35
Y	25	14	8	10
Z	-5	4	11	0

Analyse the game to suggest the strategy for two sides and also determine the value of the game.

- c. Assess the following game by solving in graphical method. 10 (5: 4: 4)

	A	B	C	D
M	19	6	7	5
N	7	3	14	6
O	12	8	18	4
P	8	7	13	-1

6. a. Examine the significance of network analysis in project management. 03 (3: 5: 5)
 b. Identify and explain the various phases involved in project management. 07 (4: 5: 5)
 c. A small project is composed of seven activities whose time estimates are given in the following table. 10 (5: 5: 5)

Activity		Name of the Activity	Time Required (in days)		
Event	Event		Optimistic	Most Likely	Pessimistic
1	2	A	6	6	24
1	3	B	6	12	18
1	4	C	12	12	30
2	5	D	6	6	6
3	5	E	12	30	48
4	6	F	12	30	42
5	6	G	18	30	54

Evaluate and determine using Program Evaluation and Review Technique:

- (i) The expected duration and variance for each activity.
 (ii) The expected the project length.
 (iii) The variance and standard deviation of the project length.

7. a. Write a note on different types of floats. 03 (3: 4: 4)
 b. Distinguish between the CPM and PERT under project management. 07 (4: 4: 4)
 c. In a sales emporium, four salesmen A, B, C and D are available to four counters W, X, Y and Z. Each salesman can handle any counter. The service (in hours) of each counter when manned by each salesman is given below: 10 (5: 4: 4)

	A	B	C	D
W	41	72	39	52
X	22	29	49	65
Y	27	39	60	51
Z	45	50	48	52

Evaluate and determine how should the salesman be allocated to appropriate counters so as to minimize the service? Each salesman must handle only one counter.

8. Case Study

- a. Assess the initial basic feasible solution of the following transportation problem using least-cost method. 10 (5: 3: 3)

Factory	Distribution Centres				Capacity (in units)
	Bengaluru	Mumbai	Delhi	Chennai	
Ahmedabad	6	8	8	5	30
Ernakulum	5	11	9	7	40
Hyderabad	8	9	7	13	50
Demand (in units)	35	28	32	25	

Costs are expressed in terms of rupees per unit shipped. Determine how much quantity should be shipped from the factory to various distribution centres.

- b.** A small project consists of the following jobs whose time estimates are **10** **(6: 5: 5)**
given below:

Job	1-2	1-3	2-3	2-5	3-4	3-6	4-5	4-6	5-6	6-7
Time (Days)	15	15	3	5	8	12	1	14	3	14

Evaluate using Critical Path Method and determine float for each activity, critical path and total project duration. Also draw an arrow diagram representing the project.

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