

Plot No. 2, Knowledge Park-III, Greater Noida (U.P.) –201306

POST GRADUATE DIPLOMA IN MANAGEMENT (2025-27)
END TERM EXAMINATION (TERM-III)

Subject Name: **Decision Science**

Time: **02.00 hrs**

Sub. Code: **PG306**

Max Marks: **40**

Note: All questions are compulsory. Section A carries 12 marks: 6 questions of 2 marks each, Section B carries 18 marks having 3 questions (with internal choice question in each) of 6 marks each and Section C carries 10 marks one Case Study having 2 questions of 5 marks each.

Kindly write the all the course outcomes as per your TLEP in the box given below:

Cos	Statement of Course Outcomes	Bloom's Taxonomy
CO-1	Understand the theoretical and conceptual frameworks of decision sciences and quantitative techniques in decision-making processes.	Remember - L-1 Understand - L-2
CO-2	Apply knowledge of linear programming to formulate and solve real-world decision-making problems.	Apply - L-3
CO-3	Evaluate and optimize solutions for transportation and assignment problems using various methods, including SOLVER tools.	Evaluate - L-5.
CO-4	Analyze game theory strategies, including pure and mixed strategies, to solve two-person zero-sum games and demonstrate dominance-based solutions.	Analyze - L-4
CO5	Create models to address sequencing and queuing problems, including birth and death processes, and analyze queuing models for multiple service stations.	Analyze - L-4 Create - L-6
CO6	Develop critical thinking skills to implement and manage decision-making models, techniques, and quantitative strategies in complex organizational scenarios.	Evaluate - L-5 Create - L-6

SECTION - A

Attempt all questions. All questions are compulsory.

2×6 = 12 Marks

Questions	CO	Bloom's Level
Q. 1: (A). Differentiate between Maximax and Maximin approaches. Q. 1: (B). What is meant by constraints in linear programming? Q. 1: (C). Distinguish between feasible solution and optimal solution in LP problem. Q. 1: (D). What is an unbalanced transportation problem? Q. 1: (E). Distinguish between pure strategy and mixed strategy. Q. 1:(F). What is meant by opportunity loss in decision theory? (Three questions each from CO1 & CO2)		

SECTION – B

All questions are compulsory (Each question has an internal choice. Attempt anyone (either A or B) from the internal choice)

6 x 3 = 18 Marks

Questions	CO	Bloom's Level																												
Q. 2: (A). A consumer electronics company, is planning to launch a new smart wearable device. The company is considering three production strategies: • Strategy A: Small-scale production • Strategy B: Medium-scale production • Strategy C: Large-scale production The demand for the product is uncertain and can be categorized as Low, Moderate, or High. The estimated profits (in ₹ lakhs) under different demand conditions are given below: <table><tr><th>Strategy</th><th>Low Demand</th><th>Moderate Demand</th><th>High Demand</th></tr><tr><td>A</td><td>20</td><td>40</td><td>60</td></tr><tr><td>B</td><td>10</td><td>50</td><td>90</td></tr><tr><td>C</td><td>-10</td><td>60</td><td>120</td></tr></table> The probabilities of demand are as follows: • Low Demand = 0.3 • Moderate Demand = 0.5 • High Demand = 0.2 Questions: 1. Determine the best strategy using the Expected Monetary Value (EMV) criterion. 2. Determine the best strategy using the Expected Opportunity Loss (EOL) criterion. Or Q. 2: (B). A manufacturing firm, Ikea Furniture Ltd., produces two products: Executive Tables (X) and Ergonomic Chairs (Y). Production requires time in two departments—Carpentry and Finishing—with limited daily capacity. Resource Requirements and Availability <table><tr><th>Department</th><th>Tables (X)</th><th>Chairs (Y)</th><th>Available Hours/Day</th></tr><tr><td>Carpentry</td><td>3 hours</td><td>2 hours</td><td>120</td></tr><tr><td>Finishing</td><td>2 hours</td><td>1 hour</td><td>100</td></tr></table> The profit contribution is: • Table (X) = ₹700 per unit • Chair (Y) = ₹500 per unit Required: 1. Formulate the Linear Programming model. 2. Solve using the graphical method. 3. Determine the optimal production plan and maximum profit. (internal choices with two questions corresponding to the same CO) Q. 3: (A). A fast-growing FMCG distribution company, Southern Fresh Pvt. Ltd., operates three regional warehouses located at Bengaluru (W1), Chennai (W2), and Hyderabad (W3). The company supplies packaged food products to four major retail markets in South India: Kochi (D1), Coimbatore (D2), Madurai (D3), and Vijayawada (D4). With increasing logistics costs and competitive pressure, the firm seeks to determine the most cost-efficient transportation plan that minimizes total distribution cost while fulfilling demand at all markets. Find the total transportation cost using Vogel's Approximation Method. Also discuss the managerial insights of using VAM method	Strategy	Low Demand	Moderate Demand	High Demand	A	20	40	60	B	10	50	90	C	-10	60	120	Department	Tables (X)	Chairs (Y)	Available Hours/Day	Carpentry	3 hours	2 hours	120	Finishing	2 hours	1 hour	100		
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From \ To	D1 (Kochi)	D2 (Coimbatore)	D3 (Madurai)	D4 (Vijayawada)	Supply
W1 (Bengaluru)	7	5	9	8	25
W2 (Chennai)	6	8	7	3	35
W3 (Hyderabad)	4	6	5	7	40
Demand	30	30	20	20	

Or

Q. 3: (B). A manufacturing firm is facing challenges in allocating its limited resources efficiently across multiple product lines. To improve profitability and operational efficiency, the management is considering the use of Linear Programming (LP) as a decision-support tool.

- In this context, define Linear Programming and identify its key concepts.
- Explain any two important concepts of Linear Programming with reference to the above business situation.
- Discuss how Linear Programming can support managerial decision-making in such scenarios. Provide suitable business applications.

Q. 4: (A). Business Problem: A technology consulting firm, Zen Tech Solutions Ltd., has secured four high-value client projects. The firm must assign its four senior analysts to these projects. Due to differences in expertise, the estimated project completion time (in days) varies.

The management's objective is to minimize total completion time while ensuring that each analyst is assigned to exactly one project.

Analysts \ Projects	P1	P2	P3	P4
A1	10	19	8	15
A2	10	18	7	17
A3	13	16	9	14
A4	12	19	8	18

Minimize total completion time using the **Hungarian Method**. Further mention the managerial insights on the solution. **All steps must be the part of your solution.**

Or

Q. 4: (B). Two competing firms, Firm A and Firm B, are planning their capacity expansion strategies in a growing market. Each firm can choose one of the following strategies:

- Large Capacity (L)
- Medium Capacity (M)
- Small Capacity (S)

The payoff matrix (in ₹ lakhs) represents the profit of Firm A (and loss to Firm B), making it a two-person zero-sum game.

Payoff Matrix (Firm A's Payoff)

A \ B	L	M	S
L	4	1	3
M	2	3	2
S	1	2	1

Solve the mixed strategy problem and find the value of the game. All steps must be the part of your solution.

SECTION - C

Read the case and answer the questions

5×02 = 10 Marks

Questions	CO	Bloom's Level																																												
Q. 5: Case Study: Production Scheduling at Shakti Steel Industries Ltd. Shakti Steel Industries Ltd., a leading player in the steel manufacturing sector, has recently secured a high-value contract to supply specialized steel components for a major infrastructure project. The order consists of 10 production batches (J1–J10), each requiring sequential processing through three critical stages: • Machine A – Rolling Mill (initial shaping) • Machine B – Heat Treatment Furnace (strengthening process) • Machine C – Finishing & Polishing Unit (final processing) The production system follows a flow-shop arrangement, where: • Each batch must pass through machines in the same order (A → B → C) • Each machine can process only one batch at a time • No overlapping or pre-emption is allowed Given the high energy cost of furnaces, limited machine capacity, and strict delivery deadlines, the plant manager must determine an optimal processing sequence to minimize total production time (makes pan) and ensure efficient operations. Processing Time (in hours) <table><tr><th>Machine \ Jobs</th><th>J1</th><th>J2</th><th>J3</th><th>J4</th><th>J5</th><th>J6</th><th>J7</th><th>J8</th><th>J9</th><th>J10</th></tr><tr><td>Machine A</td><td>4</td><td>9</td><td>8</td><td>6</td><td>3</td><td>10</td><td>7</td><td>5</td><td>12</td><td>8</td></tr><tr><td>Machine B</td><td>2</td><td>1</td><td>4</td><td>5</td><td>3</td><td>2</td><td>3</td><td>2</td><td>4</td><td>5</td></tr><tr><td>Machine C</td><td>6</td><td>8</td><td>9</td><td>7</td><td>5</td><td>11</td><td>10</td><td>6</td><td>12</td><td>10</td></tr></table>	Machine \ Jobs	J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	Machine A	4	9	8	6	3	10	7	5	12	8	Machine B	2	1	4	5	3	2	3	2	4	5	Machine C	6	8	9	7	5	11	10	6	12	10		
Machine \ Jobs	J1	J2	J3	J4	J5	J6	J7	J8	J9	J10																																				
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Machine C	6	8	9	7	5	11	10	6	12	10																																				
Questions: Q. 5: (A). Using an appropriate sequencing technique, determine the optimal sequence of jobs to minimize total elapsed time. Clearly show all intermediate steps. Q. 5: (B). Based on the sequence obtained, compute the minimum total elapsed time. Idle time of each machine. Briefly explain the operational benefits of optimal sequencing in steel manufacturing.																																														

ssKindly fill the total marks allocated to each CO's in the table below:

COs	Marks Allocated	Questions
CO1		
CO2		
CO3		
CO4		
CO5		
CO6		

(Please ensure the conformity of the CO wise marks allocation as per your TLEP.)

Blooms Taxonomy Levels given below for your ready reference:

L1= Remembering

L2= Understanding

L3= Apply

L4= Analyze

L5= Evaluate

L6= Create