K. K. Wagh Institute of Engineering Education and Research, Nashik
(An Autonomous Institute from A. Y. 2022-23)

Marking Scheme
End-Sem Examination-I, Winter 2025

Academic Year: 2025-2026	Semester: Sem III
Class: PG I	Program: MBA
Branch Code: 10	Pattern: 2024
Name of Course: Decision Science	Course Code: 2410506

<table>
<tr><th>Q. No.</th><th>Details</th><th>Max. Marks</th></tr>
<tr><td>Q.1</td><td>Discuss about the different types of quantitative models used in business.
Mentioning the types and explaining it – 6 Marks</td><td>[6]</td></tr>
<tr><td>Q.2</td><td>An airline Co. has drawn-up a new flight schedule involving five flights. To assist in allocating five pilots to the flights it has asked them to state their preference scores by giving each flight a number out of 10. The higher the number, the greater is the preference. Certain of these flights are unsuitable to some pilots owing to some domestic reasons. These have been marked with x. What should be the allocation of the pilots to flights in order to meet as many preferences as possible.
<table>
<tr><td></td><td colspan="6">Flight Number</td></tr>
<tr><td rowspan="6">PILOT</td><td></td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr>
<tr><td>A</td><td>8</td><td>2</td><td>X</td><td>5</td><td>4</td></tr>
<tr><td>B</td><td>10</td><td>9</td><td>2</td><td>8</td><td>4</td></tr>
<tr><td>C</td><td>5</td><td>4</td><td>9</td><td>6</td><td>X</td></tr>
<tr><td>D</td><td>3</td><td>6</td><td>2</td><td>8</td><td>7</td></tr>
<tr><td>E</td><td>5</td><td>6</td><td>10</td><td>4</td><td>3</td></tr>
</table>
Calculation of assignment problem with proper steps- 3*2=6 Marks</td><td>[6]</td></tr>
<tr><td>Q.3</td><td>a) Goods have to be transported from sources S1, S2, and S3 to destinations D1, D2, and D3. The transportation cost per unit, capacities of the sources, and the requirements of the destinations are given in the following table:
<table>
<tr><th></th><th>D1</th><th>D2</th><th>D3</th><th>D4</th><th>Supply</th></tr>
<tr><td>S1</td><td>2</td><td>3</td><td>11</td><td>7</td><td>6</td></tr>
<tr><td>S2</td><td>1</td><td>0</td><td>6</td><td>1</td><td>1</td></tr>
<tr><td>S3</td><td>5</td><td>8</td><td>15</td><td>9</td><td>10</td></tr>
<tr><td>Demand</td><td>7</td><td>5</td><td>3</td><td>2</td><td></td></tr>
</table>
Determine the initial feasible solution (NWC, LCM, VAM) so that cost is minimised.
LP formulation: 1 Marks
Calculation of NWCM:2 Marks
Calculation of LCM:2 Marks
Calculation of VAM:3 Marks
OR
b) Explain the concept of Queuing theory - System, Terminologies and Formulas.</td><td>[16]

8+8</td></tr>
</table>

Concept, system explanation-4 Marks
Terminologies and formulas- 4 Marks

c) A company has factories at *F*1, *F*2, and *F*3 that supply products to warehouses at *W*1, *W*2 and *W*3. The weekly capacities of the factories are 7, 9 and 18 units, respectively. The weekly warehouse requirements are 5, 8, 7 and 14 units, respectively. The unit shipping costs (in rupees) are as follows:

Warehouse	***Factory***			
	W1	W2	W3	W4
F1	19	30	50	10
F2	14	8	18	60
F3	26	24	16	20

Determine the optimal distribution for this company in order to minimize its total shipping cost.

(8 marks)

Applying any of NWC, LCM or VAM:4 Marks
MODI method: 4 Marks

OR

d) i)In a railway marshalling yard, goods train arrive at a rate of 30 trains per da. Assuming that the interval time follows an exponential distribution and the service time distribution is also exponential with an average of 36 minutes. Calculate:
a. Expected queue size (Line length).
b. Calculate the waiting time for the customer in queue.
ii) Discuss the importance of Transportation Problem and Queuing Theory in management field with examples.

i) Calculation two questions with formula-4 Marks
ii) Importance of Transportation and Queuing Theory – 4 Marks

Q.4

a) A project has been defined to contain the following list of activities along with their required time of completion.

Activity	A	B	C	D	E	F	G	H	I
Time in Days	1	4	3	7	6	2	7	9	4
Immediate Predecessor	-	A	A	A	B	C	E, F	D	G, H

I. Draw the network diagram.
II. Show early start time and early finish time.
III. Identify critical path.
IV. What would happen if duration of activity F is taken as four days instead of two?

Answering each question carries 2 Marks.

[16]

8+8

OR

b) The three estimates of time in weeks for activities of a project are given below:

Activity	**1-2**	**1-3**	**1-4**	**2-5**	**3-5**	**4-6**	**5-6**
Pessimistic	7	7	12	15	1	8	7

Time								
Most Likely Time	6	1	4	6	1	2	4	
Optimistic Time	5	1	2	3	1	2	1	

Draw network diagram. Find out Critical path & Project duration. Estimate expected Standard deviation of critical path.

Network Diagram, Calculating critical path, project duration and standard deviation- each carries 2 marks

c) The activities of a project an estimated times in days for each activity are given below:

Activity	1-2	1-3	1-4	2-3	2-6	3-5	4-5	4-6	5-6
Duration (in days)	8	10	8	10	16	17	18	14	9

i) Draw network diagram ii) Find critical path iii) Calculate total float and free float

(8 marks)

Answering i) and ii) with proper steps– 5 Marks

Answering iii) with formula for non-critical activities – 3 Marks

OR

d) A Company manufacturing plant and equipment for chemical processing is in the process of quoting a tender called by a public sector undertaking. Th delivery data, once promised is crucial and a penalty clause is applicable. The project manager has listed down the activities in the project as under:

Activity	**Immediate Predecessor**	**Activity Time (In Weeks)**		
		Optimistic Time	**Most Likely Time**	**Pessimistic Time**
A	-	1	3	5
B	-	2	4	6
C	A	3	5	7
D	A	5	6	7
E	C	5	7	9
F	D	6	8	10
G	B	7	9	11
H	E,F,G	2	3	4

a) Find out the delivery week from the date of commencement of the project.

b) Find the total float and free float for each of Non- Critical Activities.

Answering a) with network diagram, critical path and duration: 4 Marks

Answering b) with formula: 4 Marks

Q.5 a) Solve the following game [16]

Player A	Player B		
	B1	B2	B3

				8+8

A1	1	7	2
A2	6	2	7
A3	5	1	6

Saddle point check-2 marks
Applying rule of dominance-3 Marks
Calculation of p1, p2, q1, q2 and value of game – 3 Marks

OR

b) Dr. Kelkar has been thinking about starting his own independent nursing home. The problem is to decide how large the nursing home should be. The annual returns will be depending on both size of nursing home and number of marketing factors. after a careful analysis, Dr. Kelkar developed following table:

Size of Nursing Home	**Good Market (Rs.)**	**Fair Market (Rs.)**	**Poor Market (Rs.)**
Small	50,000	20,000	-10,000
Medium	70,000	35,000	-25,000
Large	90,000	35,000	-45,000
Very Large	2,00,000	25,000	-1,20,000

Find optimal strategy using i) Laplace ii) Hurwicz (a-0.8) iii) Maximax iv) Regret
Calculating each question carries 2 marks with proper steps.

c) A company decides on production allocation of 1000 units across three plants (A:400, B:350, C:250 max capacity) to two markets (X:500, Y:600 demand) under uncertain demand scenarios. Strategies: S1 (prioritize X), S2 (balance), S3 (prioritize Y). Profits per scenario: Strong X demand (prob 0.4), Balanced (0.3), Strong Y (0.3).

Payoff Table (Profits $000s)

Strategy /Scenario	**Strong X (0.4)**	**Balanced (0.3)**	**Strong Y (0.3)**
S1 (Prioritize X)	240	180	120
S2 (Balance)	220	200	180
S3 (Prioritize Y)	160	170	240

Calculate EMV, EOL and EVPI.
(8 marks)
Calculating EMV: 2 Marks
Calculating EOL(For regret table): 4 Marks
Calculating EVPI: 2 Marks

OR

d) Determine the optimal strategies for A & B in the following game. Obtain value of game.

		PLAYER B		
		B1	**B2**	**B3**
PLAYER A	**A1**	9	8	-7
	A2	3	-6	4
	A3	6	7	7

Saddle point check-2 marks
Applying rule of dominance-3 Marks
Calculation of p1,p2,q1,q2 and value of game – 3 Marks

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Model Answer
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Q. 1 [6]

Discuss about the different types of quantitative models used in business. (6 marks)

Students can explain any few of the models

1. Function
   - Descriptive
   - Predictive
   - Normative
2. Structure
   - Iconic
   - Analog
   - Symbolic
3. Dimensionality
   - Two-dimensional
   - Multidimensional
4. Degree of certainty
   - Certainty
   - Conflict
   - Risk
   - Uncertainty
5. Time reference
   - Static
   - Dynamic
6. Degree of generality
   - Specialized
   - General
7. Degree of closure
   - Closed
   - Open
8. Degree of quantification
   - Qualitative
     - Mental
     - Verbal
   - Quantitative
     - Statistical
     - Heuristic
     - Simulation

Q. 2 [6]

An airline Co. has drawn-up a new flight schedule involving five flights. To assist in allocating five pilots to the flights it has asked them to state their preference scores by giving each flight a number out of 10. The higher the number, the greater is the preference. Certain of these flights are unsuitable to some pilots owing to some domestic reasons. These have been marked with x. What should be the allocation of the pilots to flights in order to meet as many preferences as possible.

		Flight Number				
		1	**2**	**3**	**4**	**5**
PILOT	**A**	8	2	X	5	4
	B	10	9	2	8	4
	C	5	4	9	6	X
	D	3	6	2	8	7
	E	5	6	10	4	3

(6 marks)

This is a maximisation problem. First reduce it to minimisation by subtracting highest element with each element of the matrix. Resultant matrix and calculations are provided below.