Seat No. : _____

DJ-105

December-2025

IMBA, Sem.-VII

Quantitative Techniques for Management – I

Time : 2:30 Hours] **[Max. Marks : 70**

Notes : (1) Logarithmic Tables and Financial Tables shall be provided on request.
(2) Non-Programmable Scientific Calculators are allowed.

1. (A) Define Perpetuity. What is its future value ? **2**

(B) Attempt ANY **THREE** of the following : **12**

(i) Mr. X deposited ₹ 10,000 in a bank for three years, offering interest at the rate of 6% compounded half-yearly during the first year, at the rate of 12% compounded quarterly during the second year and at 10% compounded continuously during third year. Find his balance after three years.

(ii) A person is to pay a sum of ₹ 75,000 at the end of 6^{th} year from now. However, he makes a payment of ₹ 30,000 now, ₹ 20,000 at the end of the 4^{th} year and agrees to pay ₹ 10,000 at the end of the 8^{th} year. How much should he pay at the end of 6^{th} year to discharge the entire liability, if the rate of interest is 3% per annum ?

(iii) Mr. Ram, businessman, plans to shift his business from Delhi to Faridabad because of closure of certain type of industries in Delhi. He has to make a decision between two machines, both of which are designed to improve operation by saving the labour cost. Machine A costs ₹ 7,750 and will generate the annual labour savings of ₹ 2,300. Machine B costs ₹ 9,750 and will save ₹ 2,400 annually. Machine A has a useful life of 6 years while Machine B has a useful life of 8 years. If time value of money is 10% per annum, which machine is preferable ?

(iv) Suppose an asset costs ₹ 48,000, its scrap value is ₹ 2,500 and the estimated economic life of the asset is 8 years. Prepare a depreciation schedule by Constant Percentage of Book Value Method.

2. Attempt ANY **TWO** of the following : **14**

(A) Consider the following payoff matrix with respect to Player A and solve it optimally.

		Player B	
		1	**2**
Player A	**1**	6	9
	2	8	4

(B) Solve the following Game :

		Player B		
		1	**2**	**3**
Player A	**1**	–3	4	2
	2	7	8	5
	3	6	2	9

(C) Consider the details of a distance network as shown below :

Arc	**Distance**
1-2	3
1-3	8
1-4	10
2-3	4
2-4	7
3-4	2
3-5	8
4-5	6

Construct the distance network. Find the shortest path from node 1 to node 5.

3. Attempt ANY **TWO** of the following : **14**

(A) ABC Furniture produces three products: tables, desks and chairs. All furniture is produced in the central plant. Production of desk requires 3 hours in the plant, a table takes 2 hours and a chair only 1 hour. The regular plant capacity is 40 hours a week. According to the marketing department, the maximum number of desks, tables and chairs that can be sold are 10, 10 and 12 respectively. The president of the firm has established the following goal priorities :

P_1 : Avoid any underutilization of production capacity.

P_2 : Achieve the sales goals of 10 desks, 10 tables and 12 chairs.

P_3 : Minimise the overtime operation as much as possible.

Formulate the given problem as a goal programming problem. **(DO NOT SOLVE IT.)**

(B) Solve the following integer programming problem :

Maximise $Z = x_1 + 5x_2$

Subject to :

$x_1 + 10x_2 \leq 20$

$x_1 \leq 5$

x_1, x_2 are non-negative integers.

(C) Solve the following goal programming problem :

Minimize $Z = d^-$

Subject to :

$120x_1 + 90x_2 + d^- - d^+ = 2100$

$6x_1 + 3x_2 \leq 90$

$3x_1 + 6x_2 \leq 72$

$x_1, x_2, d^-, d^+ \geq 0$

4. A project consists of activities from A to J as shown in the following table. The immediate predecessor(s) and the duration in weeks of each of the activities are given in the same table. Draw the project network, find the critical path and the corresponding project completion time. Also, find the total float as well as free float for each of the non-critical activities. **14**

Activity	Immediate Predecessor(s)	Duration (weeks)
A	–	4
B	–	3
C	A, B	2
D	A, B	5
E	B	6
F	C	4
G	D	3
H	F, G	7
I	F, G	4
J	E, H	2

OR

4. The owner of a chain of fast food restaurants is considering a new computer system for accounting and inventory control. A computer company sent the following information about the computer system installation : **14**

Activity	Activity Description	Immediate Predecessor(s)	Duration (Days)		
			Optimistic	Most Likely	Pessimistic
A	Select the computer model	–	4	6	8
B	Design input/output system	A	5	7	15
C	Design monitoring systems	A	4	8	12
D	Assemble computer hardware	B	15	20	25
E	Develop the main programmes	B	10	18	26
F	Develop input/output routines	C	8	9	16
G	Create the data base	E	4	8	12
H	Install the system	D, F	1	2	3
I	Test and implement	G, J	6	7	8

(i) Construct an arrow diagram for this problem.

(ii) Determine the critical path and compute the expected completion time.

(iii) Determine the probability of completing the project in 55 days.

5. Attempt ANY **TWO** of the following : **14**

(A) Explain :

(i) Time Series

(ii) Cyclic Fluctuations

(iii) Irregular Variation

(B) The following data shows the exports of raw cotton and the value of imports of manufacturing goods into India for 7 years :

Crores of Rupees

Exports :	42	44	58	55	89	98	60
Imports :	56	49	53	58	67	76	58

Ascertain the regression equation of imports on exports and estimate the import when exports in a particular year were to the value of ₹ 70 crores.

(C) Use exponential smoothing technique to complete forecasts for the following series of data, when smoothing constant is 0.3 :

Period :	1	2	3	4	5	6	7	8	9	10
Observation :	27	30	32	31	28	27	30	33	33	31