Seat No. : _____

NN-103

November-2025

Integrated LL.B., Sem.-III

IL-BBA-202 : O.R. & Q.T.

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

Instructions : (1) Figures to the right indicate marks.
(2) Simple calculator is allowed.

1. (A) Write the mathematical form of a linear programming problem. **6**

OR

1. (A) Write a short note on "Techniques of O.R."

1. (B) Find the values of x_1, x_2 such that $Z = 3x_1 + 4x_2$ is maximum subject to the following constraints : **12**

$2x_1 + 5x_2 \leq 120$

$4x_1 + 2x_2 \leq 80$

$x_1, x_2 \geqq 0$

OR

1. (B) A company manufactures two types of bicycles A and B. For this two machines M and N are used, Machine M can be used for 60 hours and machine N can be used for 40 hours in a week. For manufacturing each bicycle of type A machine M is used for 1 hour and machine N is used for 2 hours, while for manufacturing each bicycle of type B machine M is used for 2.5 hours and machine N is used for 1 hour. The profit on each bicycle of type A is ₹ 60 and that on type B is ₹ 80. How many bicycles of each type should be manufactured per week so as to get maximum profit ?

2. (A) Explain Matrix-minima method for finding an initial solution for a transportation problem. **6**

2. (B) Find Optimal Solution of the following transportation problem by using VAM Method : **12**

		Sales Centre				**Supply**
		S_1	S_2	S_3	S_4	
Godown	A	**12**	**14**	**9**	**4**	**38**
	B	**9**	**17**	**8**	**15**	**24**
	C	**5**	**12**	**11**	**14**	**28**
Demand		**30**	**12**	**22**	**26**	

OR

2. (B) Obtain optimal solution for the following transportation problem using Least Cost Method :

Sales Outlets	**Plants**			**Supply**
	P1	P2	P3	
S1	60	40	240	3
S2	100	65	180	5
S3	260	210	60	6
Demand	6	4	4	

3. (A) What are assignment problem ? Explain briefly its assumptions. **6**

OR

3. (A) Write a short note on : Dominance Property.

3. (B) Solve the following Game using dominance property : **6**

	PLAYER 2			
PLAYER 1	**8**	**10**	**9**	**14**
	10	**11**	**8**	**12**
	13	**12**	**14**	**13**

3. (C) The owner of a small machine shop has four mechanics available to assign jobs for the day. Five jobs are offered with expected profit for each mechanic on each job which is as follows : **6**

	Job					
		I	II	III	IV	V
Mechanic	A	**62**	**78**	**50**	**111**	**82**
	B	**71**	**84**	**61**	**73**	**59**
	C	**87**	**92**	**111**	**71**	**81**
	D	**48**	**64**	**87**	**77**	**80**

Find by using the assignment method, the assignment of mechanics to the job that will result in a maximum profit. Which job should be declined ?

OR

3. (C) An Indian company is preparing a network for laying the foundation of a new museum. Given the following set of the activities, their predecessor requirements and three time estimates of completion time. Draw the network and determine critical path.

Activity	Predecessor	Time Estimates (Weeks)		
		Optimistic	Pessimistic	Most Likely
A	-	2	4	3
B	-	8	8	8
C	A	7	11	9
D	B	6	6	6
E	C	9	11	10
F	C	10	18	14
G	C,D	11	11	11
H	F,G	6	14	10
I	E	4	6	5
J	I	3	5	4
K	H	1	1	1

4. (A) Short Notes : (Any **Two**) **10**

(1) Optimality Test

(2) Application and scope of O.R.

(3) Limitations of Linear Programming Problem.

(4) Explain Models in O.R.

4. (B) Select correct option and write down answer with correct option. **6**

(1) In the transportation problem, if the total supply exceeds the total demand, the problem is :

(a) Balanced

(b) Unbalanced

(c) Degenerate

(d) Infeasible

(2) In LPP, which of the following is a feasible solution ?

(a) Any solution that violates one or more constraints.

(b) Any solution that satisfies all constraints.

(c) Any solution that maximizes the objective function without considering constraints.

(d) A solution that only satisfies the objective function.

(3) The critical path in CPM is :

(a) The shortest path through the network

(b) The path with the least number of activities

(c) The longest path through the network with zero slack

(d) The path with maximum float

(4) Which of the following is NOT a characteristic of Operations Research (OR) models ?

(a) They require mathematical representation

(b) They focus only on qualitative data

(c) They seek optimal solutions

(d) They are used for decision-making

(5) The assignment problem is a special case of the transportation problem where

(a) All supply and demand values are 1

(b) All costs are zero

(c) All supply and demand values are infinite

(d) All transportation paths are equal

(6) A saddle point in a payoff matrix corresponds to :

(a) A position where both players can increase their gains

(b) The maximum of the row minima and the minimum of the column maxima

(c) A point where one player dominates the game

(d) A condition for a non-zero sum game