October 2025
B.A./B.Sc.
Fifth Semester
DISCIPLINE SPECIFIC ELECTIVE – 1
STATISTICS
Course Code: STD 5.11
(Operations Research)

Total Mark: 70   *Pass Mark: 28*
Time: 3 hours

Answer <u>five</u> questions, taking <u>one</u> from each unit.

UNIT–I

1. (a) Give two definitions of operations research. Explain the historical background on how operations research has been developed.   2+3=5
   (b) What do you mean by modelling in operations research?   3
   (c) Solve the following linear programming problem (LPP) by graphical method: 6

   Maximize $Z = 3x_1 + 5x_2$

   Subject to constraints

   $x_1 + x_2 \leq 4$

   $x_1 + 3x_2 \leq 6$ and $x_1, x_2 \geq 0$

2. (a) What is the objective of linear programming? Define basic feasible solution in LPP.   2+3=5
   (b) A company manufactures two products P_1 and P_2. Each unit of P_1 requires 2 hours on machine M_1 and 1 hour on machine M_2. Each unit of P_2 require 1 hour on M_1 and 1 hour on M_2. Machine M_1 has 6 hours available, and M_2 has 4 hours. The profit is Rs. 60 per unit of P_1 and Rs. 40 per unit of P_2. Formulate the LPP.   4

(c) Formulate the dual of the following LPP: 5

Maximize $Z = 4x_1 + 6x_2$

Subject to constraints

$2x_1 + 3x_2 \geq 12$

$x_1 + x_2 \geq 8$ and $x_1, x_2 \geq 0$

UNIT–II

3. (a) Define unbalanced transportation problem. Derive the theorem when there is excess of availability i.e., $\sum a_i \geq \sum b_j$. 1+5=6

(b) With usual notations define assignment problem and give its mathematical formulation. 4

(c) A firm has three factories F_1, F_2, and F_3 and three warehouses W_1, W_2, and W_3. The unit transportation costs, supplies, and demands are:

	W_1	W_2	W_3	Supply
F_1	8	6	10	25
F_2	9	7	4	35
F_2	3	4	2	40
Demand	30	50	20	100

Solve the transportation problem. 4

4. (a) Define balanced transportation problem. Derive the theorem when there is shortage of availability i.e., $\sum a_i \geq \sum b_j$. 1+5=6

(b) Explain the steps involved in Hungarian assignment method. 4

(c) The following matrix shows three workers W_1, W_2, and W_3 and three jobs J_1, J_2, and J_3:

	J_1	J_2	J_3
W_1	9	2	7
W_2	6	4	3
W_3	5	8	1

Formulate and find the minimum-cost assignment. 4

UNIT–III

5. (a) Define game theory. What are the steps involved in solving a game? Write a note on pure strategy.   2+2+2=6
   (b) Describe a method for solving 2×2 games without a saddle point.   6
   (c) Solve the game whose payoff matrix is given a s follows: 2

	Player B	
Player A	2	2
	1	3

6. (a) Define the following: 2×2=4
      (i) Characteristics of a competitive game.
      (ii) Zero-sum and non-zero sum games.
   (b) Formulate game as a linear programming problem (LPP).   7
   (c) Solve the following payoff matrix completely by the method of dominance: 3

		Player A		
		I	II	III
Player B	I	3	2	4
	II	1	2	3
	III	0	1	2

UNIT–IV

7. (a) What do you understand by inventory and inventory control? Explain different types of inventories.   2+5=7
   (b) Explain the algebraic method used in the economic order quantity model with uniform demand (without shortages) for determining the optimal inventory cost.   7

8. (a) Write briefly on different types of variables involved in an inventory problem.   5
   (b) Discuss the costs that arise in inventory control.   5
   (c) Write a note on VED analysis.   4

9. (a) What are the requirements for the application of PERT? Give some uses and limitations of this technique.   2+3+2=7

   (b) What is a project? Give two examples. List the important four distinct features that are common to all projects.   1+1+2=4

   (c) Distinguish between PERT and CPM.   3

10. (a) List out all the activities involved in a project.   4

   (b) What is critical path analysis? Describe with example its utility in project management and control.   2+4=6

   (c) A project has the following activities with their immediate predecessors and durations (in weeks):

Activity	Predecessor	Duration
A	--	2
B	A	4
C	A	3
D	B, C	5

   Draw the network diagram, determine the critical path, and project completion time.   2+1+1=4

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