

2022
B.A./B.Sc.
Fifth Semester
DISCIPLINE SPECIFIC ELECTIVE – 1
STATISTICS
Course Code: STD 5.11
(Operations Research)

Total Mark: 70
Time: 3 hours

Pass Mark: 28

Answer five questions, taking one from each unit.

UNIT-I

1. (a) Describe the main phases of operational research. 6
- (b) Solve the following linear programming problem by graphical method by identifying the feasible region: 5
Maximize $Z = 3x_1 + 2x_2$
subject to $3x_1 + x_2 \leq 6,$
 $x_1 + x_2 \leq 1,$ and $x_1, x_2 \geq 0$
- (c) Find the dual of the following LPP: 3
Maximize $Z = 30x_1 + 42x_2$
subject to $x_1 + 3x_2 \leq 20,$
 $2x_1 + 2x_2 \leq 15,$
 $5x_1 - 4x_2 \leq 12,$ and $x_1, x_2 \geq 0.$
2. (a) What is operations research? Describe the historical background of operations research. 6
- (b) Use Big M method to solve the following LPP: 8
Maximize $Z = 3x_1 - x_2$
subject to $2x_1 + 2x_2 \geq 2,$
 $x_1 + 3x_2 \leq 3,$
 $x_2 \leq 4,$ and $x_1, x_2 \geq 0.$

UNIT-II

3. (a) What is a transportation problem? Write the mathematical form of transportation problem. 2+3=5
- (b) Obtain the initial basic feasible solution to the following transportation problem by North-West Corner Rule (NWCR) and Vogel's approximation method and compare the total cost of transportation obtained by the two methods: 9

Factory	Warehouse				Availability
	W1	W2	W3	W4	
F1	3	6	9	1	65
F2	8	11	2	5	50
F3	7	10	4	12	65
Requirements	80	30	45	40	

4. (a) What is an assignment problem? With usual notation give its mathematical formulation. 2+4=6
- (b) The following table lists down the cost of assigning jobs to various workers. Decide the optimal allocation of jobs assuming that only one job will be assigned to each worker and corresponding total cost to be incurred. 8

	Cost	Worker		
	(C_{ij})	A	B	C
Job	1	120	100	80
	2	80	90	110
	3	110	140	120

UNIT-III

5. (a) Define the game theory. Who developed the game theory? Write briefly about the classification of game theory. 2+1+2=5
- (b) Define zero-sum and non-zero sum games, strategy, and payoff matrix. 3

- (c) Define the saddle point or equilibrium point of a game. Write down the rules for determining a saddle point. Find the solution of the following game with saddle point: 2+2+2=6

		Player B				
		I	II	III	IV	V
Player A	I	-2	0	0	5	3
	II	3	2	1	2	2
	III	-4	-3	0	-2	6
	IV	5	3	-4	2	-6

6. (a) What is the minimax and maximin criteria? What are the characteristics of a competitive game? 2+2=4
- (b) What is the principle of dominance? Solve the following game by using dominance property. 2+3=5

		Player B				
		I	II	III	IV	V
Player A	I	3	5	4	9	6
	II	5	6	3	7	8
	III	8	7	9	8	7
	IV	4	2	8	5	3

- (c) Show that for any zero-sum two person game where optimal strategies are not pure strategies and for which the player A's payoff matrix is

		B	
		y_1	y_2
A	x_1	v_{11}	v_{12}
	x_2	v_{21}	v_{22}

the optimal strategy (x_1, x_2) is determined by $\frac{x_1}{x_2} = \frac{v_{22} - v_{21}}{v_{11} - v_{12}}$ and the value (v) of the game to the player A is given by

$$v = \frac{v_{11}v_{22} - v_{12}v_{21}}{v_{11} + v_{22} - (v_{12} + v_{21})}$$

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UNIT-IV

7. (a) What do you understand by inventory control? Write briefly about the different forms of inventories. Write down the two basic decisions in developing an inventory system. 2+2+2=6
- (b) Explain each one of the costs involved in inventory problems. 4
- (c) Write a short note on EOQ and the graphical method of EOQ. 4
8. (a) What are direct and indirect inventories? 3
- (b) Write down the steps in developing an inventory model. 4
- (c) What are the different types of variables involved in an inventory problem? 4
- (d) Draw the block diagram of the classification of the inventory models. 3

UNIT-V

9. (a) What are PERT and CPM? What are the purposes of using PERT and CPM techniques? 2+3=5
- (b) Mention the characteristics of PERT and CPM projects. Define event, activity, critical activity, and non-critical activity in PERT and CPM. 2+4=6
- (c) What do you understand by optimistic time, pessimistic time, and mostly likely time? 3
10. (a) What are the general guidelines in drawing a network? 4
- (b) Define earliest start time, earliest finish time, latest start time, and latest finish time. 4
- (c) What is a critical path? Write four characteristics of critical path. Distinguish between PERT and CPM. 1+2+3=6
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