



**G-035024**

Seat No. \_\_\_\_\_

**B. Sc. (Sem. V) Examination**

**April/May - 2019**

**BSCC506D : Mathematics**

*(Operation Research-I)*

Time : 3 Hours]

[Total Marks : 70

- Instructions :** (1) All the questions are compulsory.  
(2) Figure to the right side indicate marks.  
(3) Each sub questions carries equal weightage.  
(4) All notations are standard.

- 1 (a) A manufacturer produces two types of models M and N. Each M model requires 4 hours of grinding and 5 hours of polishing whereas each N model requires 3 hours of grinding and 4 hours of polishing. The manufacturer has two grinders and 3 polishers. Each grinder works at most for 40 hours and each polisher works at most for 60 hours a week. The profit on an M model is Rs. 30 and on an N model is Rs. 40. Whatever is produced in a week is sold in the market. 7

How should the manufacturer allocate his production capacity to the two types of models so that he may make a maximum profit in a week ? Formulate the LP problem.

**OR**

Prove that the intersection of two convex sets is a convex set.

- (b) Let  $\{S_1, S_2, \dots\}$  be a collection of convex sets then 7

$\bigcap_{n \in N} S_n$  is convex set. Prove this statement.

**OR**

Prove that the union of two convex set is not a convex set.

- 2 (a) Use the Simplex method to solve the following L.P. problem. 7

$$\text{Maximize } Z = 5x_1 + 4x_2$$

$$\text{Subject to } 4x_1 + 5x_2 \leq 10$$

$$3x_1 + 2x_2 \leq 9$$

$$8x_1 + 3x_2 \leq 12 \text{ and } x_1, x_2 \geq 0$$

**OR**

Solve the following LPP by two phase method :

$$\text{Minimize } Z = x_1 + x_2$$

$$\text{Subject to } 2x_1 + x_2 \geq 4$$

$$x_1 + 7x_2 \geq 7 \text{ and } x_1, x_2 \geq 0$$

- (b) Solve the following LPP by big-M method : 7

$$\text{Maximize } Z = 3x_1 - x_2$$

$$\text{Subject to } 2x_1 + x_2 \geq 2$$

$$x_1 + 3x_2 \leq 3$$

$$x_2 \leq 4 \text{ and } x_1, x_2 \geq 0$$

**OR**

Solve the following Integer Programming Problem by the Gomory's cutting plane method :

$$\text{Maximize } Z = 4x_1 + 3x_2$$

$$\text{Subject to } x_1 + 2x_2 \leq 4$$

$$2x_1 + x_2 \leq 6 \text{ and } x_1, x_2 \geq 0 \text{ are integers.}$$

- 3 (a) Define Dual-Problem. Prove that the dual of the dual is the primal LP problem. 7

**OR**

Use the Dual Simplex method to solve the following L.P. problem.

$$\text{Maximize } Z = -3x_1 - x_2$$

$$\text{Subject to } x_1 + x_2 \geq 1$$

$$2x_1 + 3x_2 \geq 2 \text{ and } x_1, x_2 \geq 0$$

- (b) Explain the concept of Duality and principle of duality. 7

**OR**

Use the principle of Duality to solve the following LP Problem :

$$\text{Minimize } Z = 2x_1 + 2x_2$$

$$\text{Subject to } 2x_1 + 4x_2 \geq 1$$

$$x_1 + 2x_2 \geq 1$$

$$2x_1 + x_2 \geq 1 \text{ and } x_1, x_2 \geq 0$$

- 4 (a) Explain the main differences between Transportation problem and Assignment Problem. 7

**OR**

Use the Least Cost method and the Vogel's Approximation method to find initial basic feasible solutions to the following transportation problem :

Origins	Destinations				Supply
	D <sub>1</sub>	D <sub>2</sub>	D <sub>3</sub>	D <sub>4</sub>	
O <sub>1</sub>	19	30	50	10	7
O <sub>2</sub>	70	30	40	60	9
O <sub>3</sub>	40	8	40	20	18
Demand	5	8	7	14	

- (b) Solve the following Transportation Problem by MODI Method :

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Factory	Warehouses				Capacity
	W <sub>1</sub>	W <sub>2</sub>	W <sub>3</sub>	W <sub>4</sub>	
F <sub>1</sub>	10	2	20	11	15
F <sub>2</sub>	12	7	9	20	25
F <sub>3</sub>	4	14	16	18	10
Requirements	5	15	15	15	

OR

Solve the following Assignment problem by the minimization criterion :

Jobs	Workers			
	A	B	C	D
J <sub>1</sub>	5	7	11	6
J <sub>2</sub>	8	5	9	6
J <sub>3</sub>	4	7	10	7
J <sub>4</sub>	10	4	8	3

- 5 Answer the following in short : (any seven)

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- (i) Define Convex set.
- (ii) Define Surplus variable.
- (iii) Define Slack variable.
- (iv) Define Artificial variable.
- (v) Define Integer Programming Problem.
- (vi) Name the method of finding an optimum solution of a transportation problem.
- (vii) Name any one method of solving an Assignment Problem.
- (viii) Name the methods of solving an LP Problem having an artificial variable.