FD-768

M.A./M.Sc. 4th Semester
Examination, May-June 2022

MATHEMATICS

Optional - A

Paper - IV

Operations Research

Time : Three Hours] [*Maximum Marks* : 80

Note : Answer any **two** parts from each question. All questions carry equal marks.

Unit-I

1. (*a*) Use dynamic programming to find the value of

Minimize $Z = y_1 \cdot y_2 \cdot y_3$

subject to the constraints :

$$y_1 + y_2 + y_3 = 5$$
$$y_1, y_2, y_3 \geq 0$$

(*b*) Find the minimum value of

$$x_1^2 + 2x_2^2 + 4x_3$$

subject to the constraints :

$$x_1 + 2x_2 + x_3 \geq 8$$
$$x_1,\ x_2,\ x_3 \geq 0$$

(*c*) Use dynamic programming to solve the L.P.P. :

Maximize $Z = 3x_1 + 7x_2$

subject to the constraints :

$$x_1 + 4x_2 \leq 8$$
$$x_2 \leq 2 \text{ and}$$
$$x_1 \geq 0$$
$$x_2 \geq 0$$

Unit-II

2. (*a*) Use graphical method in solving the following game :

$$\begin{array}{c} \\ \text{Player } B \end{array} \begin{array}{c} \text{Player } A \\ \begin{bmatrix} 2 & 2 & 3 & -2 \\ 4 & 3 & 2 & 6 \end{bmatrix} \end{array}$$

(*b*) Use matrix oddment method to solve the following 3×3 game :

$$\begin{array}{c} \\ \text{Player } A \end{array} \begin{array}{c} \text{Player } B \\ \begin{bmatrix} 2 & -1 & -2 \\ 1 & 0 & 1 \\ -2 & -1 & 2 \end{bmatrix} \end{array}$$

(*c*) Solve the following game by linear programming technique :

$$\begin{array}{c} \\ \text{Player } A \end{array} \begin{array}{c} \text{Player } B \\ \begin{bmatrix} 1 & -1 & 3 \\ 3 & 5 & -3 \\ 6 & 2 & -2 \end{bmatrix} \end{array}$$

Unit-III

3. (*a*) Find the optimum integer solution to the all-integer programming problem :

Maximize $Z = x_1 + x_2$

subject to the constraints :

$$3x_1 + 2x_2 \leq 5$$
$$x_2 \leq 2$$
$$x_1 \geq 0$$
$$x_2 \geq 0$$

and are integers.

(*b*) Describe the mixed-integer programming problem method for the solution of integer programming problem.

(*c*) Use branch and bound method to solve the following integer linear programming problems :

Maximize $Z = 2x_1 + 3x_2$

subject to the constraints :

$$5x_1 + 7x_2 \leq 35$$
$$4x_1 + 9x_2 \leq 36$$
$$x_1,\ x_2 \geq 0$$

and are integers.

Unit-IV

4. (*a*) Write a short note on optimal product mix and activity levels.

(*b*) Explain briefly the petroleum refinery operation as linear programming problem.

(*c*) Explain the assumptions of Leontief impact-output system.

Unit-V

5. (*a*) Solve the following non-linear programming problems, using the method of Lagrangian multipliers :

Minimize $Z = 6x_1^2 + 5x_2^2$

subject to the constraints :

$$x_1 + 5x_2 = 3$$
$$x_1, x_2 \geq 0$$

(*b*) Use the Kuhn-Tucker conditions to solve the following non-linear programming problems :

Minimize $Z = x_1^2 + x_2^2 + x_3^2$

subject to the constraints :

$$2x_1 + x_2 \leq 5$$
$$x_1 + x_2 \leq 2$$
$$x_1 \geq 1,$$
$$x_2 \geq 2,$$
$$x_3 \geq 0$$

(*c*) Derive the Kuhn-Tucker conditions for the quadratic programming problem.

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