Roll No : ....

Total No. of Questions : **11**] [Total No. of Printed Pages : **7**

ASP–646

M.A./M.Sc. (Final) Examination, 2021

MATHEMATICS

Paper - Opt.- V

(Operations Research)

(For Due As Paper VI)

Time : 1½ Hours] [*Maximum Marks : **100***

Section–A **(Marks : 2 × 10 = 20)**

Note :– Answer all *ten* questions (Answer limit **50** words). Each question carries **2** marks.

(खण्ड–अ) **(अंक : 2 × 10 = 20)**

नोट :– सभी **दस** प्रश्नों के उत्तर दीजिए (उत्तर-सीमा **50** शब्द)। प्रत्येक प्रश्न **2** अंक का है।

Section–B **(Marks : 4 × 5 = 20)**

Note :– Answer all *five* questions. Each question has internal choice (Answer limit **200** words). Each question carries **4** marks.

(खण्ड–ब) **(अंक : 4 × 5 = 20)**

नोट :– सभी **पाँच** प्रश्नों के उत्तर दीजिए। प्रत्येक प्रश्न में विकल्प का चयन कीजिए (उत्तर-सीमा **200** शब्द)। प्रत्येक प्रश्न **4** अंक का है।

Section–C **(Marks : 20 × 3 = 60)**

Note :– Answer any *three* questions out of five (Answer limit **500** words). Each question carries **20** marks.

(खण्ड–स) **(अंक : 20 × 3 = 60)**

नोट :– पाँच में से किन्हीं **तीन** प्रश्नों के उत्तर दीजिए (उत्तर-सीमा **500** शब्द)। प्रत्येक प्रश्न **20** अंक का है।

Section–A   2 each

1. (i) Write standard form of a Linear Programming Problem.
   (ii) Define slack and surplus variables in LPP.
   (iii) What is Sensitivity Analysis ?
   (iv) What is the advantage of revised Simplex Method ?
   (v) Define bounded variable Linear Programming Problem.
   (vi) What is All Integer Programming ?
   (vii) What is a Non-linear Programming ?
   (viii) Define Separable Programming Problem.
   (ix) What is a Quadratic Programming Problem ?
   (x) Write down the Bellman's principle of optimality.

Section–B   4 each

2. Show that there exists no feasible solution of the following L.P.P :

   Max. :

$$Z = 3x_1 + 2x_2$$

   Subject to :

$$2x_1 + x_2 \leq 2$$

$$3x_1 + 4x_2 \geq 12$$

   and $x_1, x_2 \geq 0$.

Or

   Show that the dual of the dual of a primal problem is the primal.

3. Solve by Dual Simplex method :

   Min. :

$$Z = 3x_1 + x_2$$

Subject to :

$$x_1 + x_2 \geq 1$$

$$2x_1 + 3x_2 \geq 2$$

and $$x_1, x_2 \geq 0$$

Or

The following table gives the optimal solution of a L.P.P. :

Max. :

$$Z = 3x_1 + 5x_2 + 4x_3$$

Subject to :

$$2x_1 + 3x_2 \leq 8$$

$$2x_2 + 5x_3 \leq 10$$

$$3x_1 + 2x_2 + 4x_3 \leq 15$$

and $$x_1, x_2, x_3 \geq 0$$

			c_j	3	5	4	0	0	0
C_B	B	X_B	b	Y_1	Y_2	Y_3	Y_4	Y_5	Y_6
5	α_2	x_2	50/41	0	1	0	15/41	8/41	–10/41
4	α_3	x_3	62/41	0	0	1	–6/41	5/41	4/41
3	α_1	x_1	89/41	1	0	0	–2/41	–12/41	11/41
			$z_j - c_j$	0	0	0	45/41	24/41	11/41

and max. :

$$z = \frac{765}{41}$$

Then how much C_3 and C_4 can be increased before the present basic feasible solution will no longer be optimal ?

4. Find the integer solution to the L.P.P :

Max. :

$$Z = 2x_1 + 2x_2$$

Subject to :

$$5x_1 + 3x_2 \leq 8$$

$$x_1 + 2x_3 \leq 4$$

and $x_1, x_2 \geq 0$, x_1, x_2 are integers.

Or

Using the bounded variable technique solve the following LPP :

Max. :

$$Z = x_2 + 3x_3$$

Subject to :

$$x_1 + x_2 + x_3 \leq 10$$

$$-x_1 + 2x_3 \leq 0$$

$$2x_2 - x_3 \leq 10$$

and $0 \leq x_1 \leq 8,\ 0 \leq x_2 \leq 4,\ x_3 \geq 0$

5. Write the Kuhn-Tucker conditions for the problem :

Max. :

$$Z = -x_1^2 - x_2^2 - x_3^2 + 4x_1 + 6x_2$$

Subject to :

$$x_1 + x_2 \leq 2$$

$$2x_1 + 3x_2 \leq 12$$

and $x_1, x_2 \geq 0$

Or

Solve the NLPP :

Min. :

$$Z = 2x_1^2 + 2x_2^2 + 2x_3^2 - 24x_1 - 8x_2 - 12x_3 + 10$$

Subject to :

$$x_1 + x_2 + x_3 = 11$$

$$x_1, x_2, x_3 \geq 0$$

6. Write :

$$2x_1^2 - 6x_1 x_2 - 2x_1 x_3 + 2x_2^2 + 6x_2 x_3 - 5x_3^2$$

in the form X′AX (quadratic form).

Or

Use Dynamic Programming to find maximum value of the product $x_1 x_2$ .... x_n when $x_1 + x_2 +$ .... $x_n = b$ and x_1, x_2 .... $x_n \geq 0$.

Section–C 20 each

7. Solve the following LPP by Simplex method :

Min. :

$$Z = x_1 + x_2$$

Subject to :

$$2x_1 + x_2 \geq 4$$

$$x_1 + 7x_2 \geq 7$$

and $x_1, x_2 \geq 0$

8. Use Revised Simplex Method to solve the following LPP :

Max. :

$$Z = x_1 + 2x_2$$

Subject to :

$$2x_1 + 5x_2 \geq 6$$

$$x_1 + x_2 \geq 2$$

and $$x_1, x_2 \geq 0$$

9. Using the bounded variable technique, solve the following LPP :

Max. :

$$Z = 2x_1 + x_2$$

Subject to :

$$x_1 + 2x_2 \leq 10$$

$$x_1 + x_2 \leq 6$$

$$x_1 - x_2 \leq 2$$

$$x_1 - 2x_2 \leq 1$$

and $$0 \leq x_1 \leq 3; 0 \leq x_2 \leq 2$$

10. Use separable programming algorithm to find an approximate optimal solution of the NLPP :

Max. :

$$Z = x_1 + x_2^4$$

Subject to :

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

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

11. Apply Wolfe's method to solve the quadratic programming problem :

Min. :

$$Z = -10x_1 - 25x_2 + 10x_1^2 + x_2^2 + 4x_1x_2$$

Subject to :

$$x_1 + 2x_2 \leq 10$$

$$x_1 + x_2 \leq 9$$

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