ED-618

M.A./M.Sc. 3rd Semester
Examination, March-April 2021

MATHEMATICS

Optional - A

Paper - IV

Operations Research - I

Time : Three Hours] [*Maximum Marks* : 80
[*Minimum Pass Marks* : 16

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

Unit-I

1. (*a*) Use Simplex method to solve the following linear programming problem :

Maximize $z = 6x_1 + 8x_2$

Subject to : $5x_1 + 10x_2 \leq 60$

$4x_1 + 4x_2 \leq 40$

$x_1, x_2 \geq 0$

(*b*) Solve the following linear programming problem using the result of its dual :

Minimize $z = 24x_1 + 30x_2$

Subject to : $2x_1 + 3x_2 \geq 10$

$4x_1 + 9x_2 \geq 15$

$6x_1 + 6x_2 \geq 20$

$x_1,\ x_2 \geq 0$

(*c*) Consider the following linear programming problem :

Maxmize $z = 10x_1 + 15x_2 + 20x_3$

Subject to : $2x_1 + 4x_2 + 6x_3 \leq 24$

$3x_1 + 9x_2 + 6x_3 \leq 30$

$x_1, x_2, x_3 \geq 0$

and check whether the optimality is affected, if the profit coefficients are changed from (10, 15, 20) to (7, 14, 15). If so, find the revised optimum solution.

Unit-II

2. (*a*) Solve the following linear programming problem using big-M method :

Minimize $z = 2x_1 + 3x_2$

Subject to : $x_1 + x_2 \geq 6$

$7x_1 + x_2 \geq 14$

$x_1, \ x_2 \geq 0$

(*b*) Solve the following linear programming problem using dual simplex method :

Minimize $z = 2x_1 + 4x_2$

Subject to : $2x_1 + x_2 \geq 4$

$x_1 + 2x_2 \geq 3$

$2x_1 + 2x_2 \leq 12$

$x_1, x_2 \geq 0$

(*c*) Find the Dual of the Primal :

Maximize $z = x_1 + 5x_2 + 3x_2$

Subject to : $x_1 + 2x_2 + x_3 = 3$

$2x_1 - x_2 = 4$

$x_1, x_2, x_3 \geq 0$

Unit-III

3. (*a*) Consider the following parametric linear programming problem :

Maximize $z = (10 - 2t)\, x_1 + (5 - 3t)\, x_2$

Subject to : $8x_1 + 2x_2 \leq 48$

$2x_1 + 4x_2 \leq 24$

$x_1, x_2 \geq 0$

and t is a non-negative parameter. Perform parametric analysis with respect to the objective function coefficients and identify the ranges of t over which the optimality is unaffected.

(*b*) Write a short note on interior point algorithm.

(*c*) Carry out two iterations of Karmarkar's algorithm for the following problem :

Minimize $z = x_1 - 2x_2$

Subject to : $x_1 - 2x_2 + x_3 = 0$

$x_1 + x_2 + x_3 = 1$

$x_1, x_2, x_3 \geq 0$

Unit-IV

4. (*a*) Discuss the similarities and dissimilarities between Transportation and Assignment problem.

(*b*) Use Vogel's approximation method to solve the following transportation problem :

		Destination 1	2	3	4	Supply
Source	1	3	1	7	4	300
	2	2	6	5	9	400
	3	8	3	3	2	500
Demand		250	350	400	200	

(*c*) Write steps of Hungerian method for solving Assignment problem.

Unit-V

5. (*a*) Write steps of PRIM algorithm for finding the Minimum Spanning Tree problem.

(*b*) A project is composed of 7 activities whose time estimates are listed in the table below. Activities are identified by their beginning (i) and ending (j) node numbers :

Activity (i-j)	Estimate Duration in Weeks		
	Optimistic (t_o)	Most likely (t_m)	Pessimistic (t_p)
1-2	1	1	7
1-3	1	4	7
1-4	2	2	8
2-5	1	1	1
3-5	2	5	14
4-6	2	5	8
5-6	3	6	15

(*i*) Draw the project network.

(*ii*) Find the expected duration and variance for each activity. What is the expected project length ?

(*c*) Consider the following data of the project :

Activity	Predecessor (s)	Duration (weeks)		
		t_o	t_m	t_p
A	–	3	5	8
B	–	6	7	9
C	–	4	5	9
D	*A*	3	5	8
E	*B*	4	6	9
F	*A*	5	8	11
G	*C*, *D*	3	6	9
H	*C*, *D*, *E*	1	2	9

(*i*) Construct the project network.

(*ii*) Find critical path and expected completion time.

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