

Total No. of Questions : 8]

SEAT No. :

[Total No. of Pages : 4

**PA-1658**

[5927]-335

**B.E. (Civil)**

**OPERATIONS RESEARCH**

**(2019 Pattern) (Semester-VII) (Elective-III) (401003-F)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Solve Q1 or Q2, Q3 or Q4, Q5 or Q6, and Q7 or Q8.
- 2) Figures to the right side indicate full marks.
- 3) Use of calculator is allowed.
- 4) Assume suitable data if necessary.

**Q1) a)** Solve following example using simplex method. **[8]**

$$\text{Maximize } Z = 20x_1 + 25x_2$$

Subject to

$$12x_1 + 16x_2 \leq 100$$

$$16x_1 + 8x_2 \leq 80$$

$$x_1, x_2 \geq 0$$

b) State the advantages of dual-primal equations. **[4]**

c) Define the following terms and indicate their significance of decision making with linear programming and simplex method: **[6]**

i) Key Column

ii) Key row

OR

**Q2) a)** Solve using simplex method. **[8]**

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

Subject to

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

$$4x_1 + x_2 \leq 8$$

$$4x_1 - x_2 \leq 8$$

$$x_1, x_2 \geq 0$$

**P.T.O.**

- b) Write the steps involved in two phase simplex method. [4]  
 c) Explain the following w.r.t. LPP. Give suitable example. [6]  
 i) Entering variable.  
 ii) Leaving variable.  
 iii) Artificial variable.

- Q3)** a) Explain steps involved in VAM. [6]  
 b) Optimize following transportation problem using VAM. Optimize using u-v method for one iteration only. [12]

	D1	D2	D3	D4	Supply
S1	5	3	6	4	30
S2	3	4	7	8	15
S3	9	6	5	8	15
Demand	10	25	18	7	

OR

- Q4)** a) A company has four machines on which four jobs are performed. Each job can be assigned to only one machine. The cost of each job on each machine is given in the following table. Optimize the assignment to get minimum cost. [8]

		Machines			
		A	B	C	D
Jobs	1	41	72	39	52
	2	22	29	49	65
	3	27	39	60	51
	4	45	50	48	52

- b) Find initial solution of the following transportation problem using [6]  
 i) Column minima method  
 ii) Row minima method

	A	B	C	Supply
1	20	70	40	50
2	30	30	10	80
3	50	40	70	70
4	10	60	20	140
Demand	70	90	180	

Which method gives the least cost for the above problem?

- c) What is meant by unbalanced assignment problem? State the steps to solve such problem. [4]

**Q5) a)** Optimize  $Z = x_1^2 + x_2^2 + 3x_3^2 + 10x_1 + 8x_2 + 6x_3 - 100$  [6]

Subject to  $x_1 + x_2 + x_3 = 20$

$x_1, x_2, x_3 \geq 0$

Use Lagrangian multiplier technique.

b) Carry out the calculation for finding the maxima of following equation using Fibonacci method with 1% accuracy in the interval (2,5) upto two iterations only.

Maximize  $f(x) = 12x^5 - 45x^4 + 40x^3 + 5$  [8]

c) What are similarities between Golden section method and Fibonacci method? [3]

OR

**Q6) a)** Maximize  $Z = 6x_1 + 8x_2 - x_1^2 - x_2^2$  using Lagrangian multiplier method. [8]

Subject to

$4x_1 + 3x_2 = 16$

$3x_1 + 5x_2 = 15$

$x_1, x_2 \geq 0$

b) What are the managerial decision making applications of mathematical non linear programming models? [5]

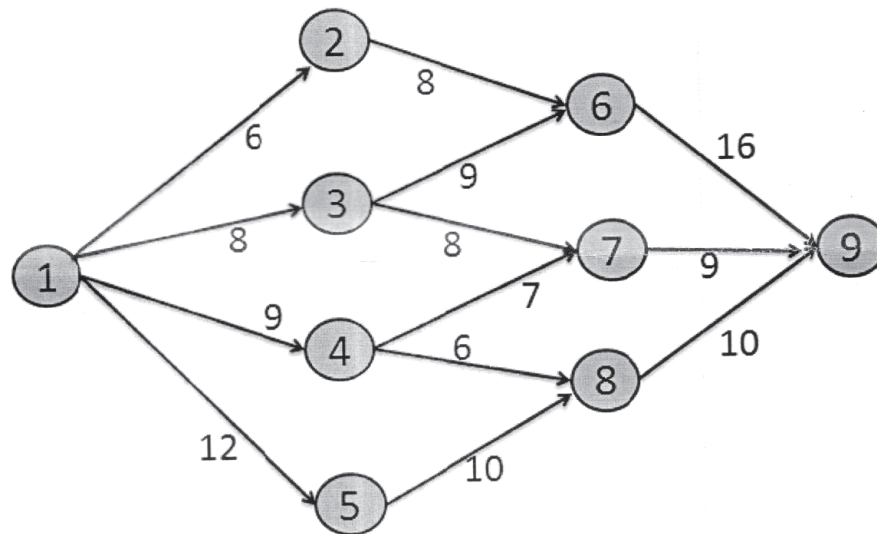
c) Using Hessian matrix, determine whether following function is convex or concave.  $f(x) = 7x_1^2 + 10x_2^2 + 7x_3^2 - 4x_1x_2 + 2x_1x_3 - 4x_2x_3$  [4]

**Q7) a)** Consider following payoff matrix for two opponents. [9]

		Opponent2			
		P	Q	R	S
Opponent 1	A	1	7	2	5
	B	0	3	7	8
	C	5	2	6	10

- Check whether there exists saddle point.
- Give optimum strategy for both the firms
- Find the value of Game

- b) Find the shortest path between nodes 1 and 9 using Dynamic programming method [8]



The numbers on the arrows represent the distance in kms.

OR

- Q8) a) A transit mixer is purchased for Rs. 30 lacs with expected life as 10 years. The running cost and resale price in lacs of Rs. is given in the following table. [9]

Year	1	2	3	4	5	6	7	8	9	10
Running Cost	6	6	6.4	6.5	7.5	9.5	10.9	12.8	14	16
Resale Price	28	27.5	27	26	24	22.5	21	20	17	13

Find the replacement year for the wheel loader.

- b) Write the applications of following OR techniques in the field of Civil engineering [8]
- Replacement analysis.
  - Dynamic Programming.

