Total No. of Questions: 8]

SEAT No. :

P537

[Total No. of Pages :4

[6004]-459
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, Q7 or Q8.***
2) ***Figures to the righte side indicate full marks.***
3) ***Use of Calculator is allowed.***
4) ***Assume suitable data if necessary.***

Q1) a) Explain the following in the context of assignment problem **[6]**

i) The Hungarian Method

ii) Infesible assignment

b) Unit cost of transporting precast blocks from four factories to three sites is given along with availability at each factory and the requirement on each site. Obtain optimal solution to minimize cost of transportation using VAM method. **[12]**

	1	2	3	4	supply
A	2	7	4	6	5
B	3	3	7	2	8
C	5	4	1	3	7
D	1	6	2	5	14
Demand	7	9	18	6	

OR

Q2) a) Six different jobs J1,J2, J3, J4 J5 and J6 are to be worked on a machine tool with setting times as given in the following matrix. It is necessary that a job once undertaken will not be handled again till all other jobs are finished. Decide the sequence of jobs which gives minimum elapsed time. **[12]**

P.T.O.

		Next jobs					
		J1	J2	J3	J4	J5	J6
	J1	-	17	20	22	6	8
	J2	21	-	18	23	17	16
	J3	23	22	-	19	22	19
Jobs	J4	27	19	21	-	20	21
Before	J5	16	18	17	23	-	17
	J6	18	16	20	24	19	-

b) What are the applications of transportation problem in Construction industry? **[6]**

Q3) a) In Simplex problem, explain the two phase method and its applications **[8]**

b) What are the advantages of Linear programming problems? **[4]**

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

i) Key cloumn

ii) Key row

OR

Q4) a) Solve using Simplex method **[8]**

Maximize $Z=2x_1-4x_2+5x_3-6x_4$

Subject to

$$x_1 + 4x_2 - 2x_3 + 8x_4 \le 2$$
$$-x_1 + 2x_2 + 3x_3 + 4x_4 \le 1$$
$$x_1, x_2, x_3, x_4 \ge 0$$

b) Under which circumstances, Big M method is used? **[4]**

c) Explain the significance of surplus and slack variables. **[6]**

Q5) a) Optimize $Z = -x_1^2 - x_2^2 + 4x_1 + 9x_2$ **[10]**

Subject to

$$4x_1 + 3x_2 = 15$$
$$3x_1 + 5x_2 = 14$$
$$x_1, x_2 \geq 0$$

Use Lagrangian Multiplier technique.

b) Give the steps involved in steepest ascent/descent method. **[7]**

OR

Q6) a) Explain the following **[7]**

i) Hessian matrix

ii) Gradient vector

b) A company sells two types of items, A and B. On item A, three is no discount and is sold at a fixed of price of Rs. 250 per unit. The sales revenue for item B is given as $(40–0.40x_2)x_2$ where x_2 is the number of units sold. The marketing department has only 1,500 hours available for selling these items in the next year. Further the company estimates the sales time function as sales time $= x_1 + 0.3x_1^2 + 3x_2 + 0.5x_2^2$. The company can procure a maximum of 6,000 units of the two products combined. Formulate the mathematical model of the problem to maximize the revenue. **[10]**

Q7) a) Solve the following 3 X 5 game using dominance property **[8]**

		Opponent 2				
		1	2	3	4	5
Opponent 1	A	6	15	30	21	16
	B	3	3	6	6	4
	C	12	12	24	35	3

Give optimum strategy for both the opponents and find value of games

b) In an investment project, Seven salesmen are to be appointed for three areas to maximize the sales. the sale in each zone w.r.t the number of salesman is as given under. Find the optimum allocation. **[9]**

N. of salesmen	0	1	2	3	4	5	6	7
Zone 1	2	4	7	12	16	19	21	22
Zone 2	3	6	10	17	22	25	27	27
Zone 3	2	3	6	10	15	19	22	23

OR

Q8) a) Why is replacement of items required? what is the strategy used for replacement of any machine? What are the types of costs to be considered for calculating the replacement year? **[9]**

b) Write the applications of following OR techniqus in the filed of Civil Engineering. **[8]**

i) Non linear Programming

ii) Dynamic programming