Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E. SEMESTER I (old course)–EXAMINATION (Remedial) – WINTER 2015

Subject code: 710904 **Date: 14/12/2015**

Subject Name: Optimization Techniques

Time: 10:30 AM to 1:00 PM **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 **(a)** The standard weight of a special purpose brick is 5 kg and it contains two basic ingredients B_1 and B_2, B_1 costs Rs. 5/kg and B_2 costs Rs. 8/kg. Strength considerations dictate that the brick contains not more than 4 kg of B_1 and a minimum of 2 kg of B_2. Since the demand for the product is likely to be related to the price of the brick, find graphically the minimum cost of the brick satisfying the above conditions. **07**

(b) Solve using Big-M method **07**

Maximize $Z = 3x_1$ ï x_2

Subject to $2x_1 + x_2$ Ò2

$x_1 + 3x_2$ Ó3

x_2 Ò4

x_1, x_2 Ó0

Q.2 **(a)** With the help of suitable examples explain the significance of (i) slack variables, (ii) surplus variables and (iii) artificial variables in context of LP modeling. **07**

(b) Solve by simplex method only the following L.P. problem **07**

Minimize $Z = x_1$ ï $3x_2 + 3x_3$

Subject to $3x_1$ ï $x_2 + 2x_3$ Ò7

$2x_1 + 4x_2$ ÓÞ 12

ï 4 $x_1 + 3x_2 + 8x_3$ Ò10

x_1, x_2, x_3 Ó0

OR

(b) Illustrate graphically infeasibility and unboundness. How can each of these be detected while applying simplex technique. **07**

Q.3 **(a)** In the context of linear programming explain the meaning and significance of sensitivity analysis with the help of suitable examples. **07**

(b) Explain Bellmanôs principle of optimality and characteristics of dynamic programming. **07**

OR

Q.3 **(a)** In the context of dynamic programming explain the forward and backward procedure. **07**

(b) Explain dynamic programming. How is it different from linear programming? Distinguish between deterministic and probabilistic dynamic programming and give some examples where dynamic programming may be used. **07**

Q.4 **(a)** Solve the following integer programming problem using cutting plane algorithm. **07**

Maximize $Z = x_1 + x_2$

Subject to the constraints

$3x_1 + 2x_2$ Ò5

x_2 Ò2

x_1, x_2 Ó0 and are integers.

(b) Use branch and bound method to solve the following LP problem. **07**

Minimize $Z = 4x_1 + 3x_2$

Subject to the constraints

$5x_1 + 3x_2$ Ó30

x_1 Ò4

x_2 Ò6

x_1, x_2 Ó0 and are integers.

OR

Q.4 **(a)** Solve the following integer programming problem using cutting plane algorithm. **07**

Maximize $Z = 3x_1 + 12x_2$

Subject to the constraints

$2x_1 + 4x_2$ Ò7

$5x_1 + 3x_2$ Ò15

x_1, x_2 Ó0 and are integers.

The optimal non-integer solution is as below :

C_j			3	12	0	0
C_B	Variables in basis	Solution values, b	x_1	x_2	s_1	s_2
12	x_2	7/4	1/2	1	1/4	0
0	s_2	39/4	7/2	0	-3/4	1
Z=21		C_j ï Z_j	-3	0	-3	0

(b) Consider a firm having two factories. The firm is to ship its products from the factories to three retail stores. The number of units available at factories X and Y are 200 and 300 respectively, while those demanded at retail stores A, B and C are 100, 150 and 250 respectively. Rather than shipping directly from factories to retail stores, it is added to investigate the possibility of trans-shipment. The transportation cost (in rupees) per unit is given below. Find the optimal shipping schedule. Find the initial solution by Vogelôs method and optimal solution by MODI method. **07**

		Factory		Retail store		
		X	Y	A	B	C
Factory	X	0	8	7	8	9
	Y	6	0	5	4	3
Retail store	A	7	2	0	5	1
	B	1	5	1	0	4
	C	8	9	7	8	0

Q.5 **(a)** A travelling salesman has to visit five cities. He wishes to start from a particular city, visit each city once and then return to his starting point. The travelling cost (in thousand rupees) of each city from a particular city is given below : **07**

		A	B	C	D	E
From city	A	Đ	2	5	7	1
	B	6	Đ	3	8	2
	C	8	7	Đ	4	7
	D	12	4	6	Đ	5
	E	1	3	2	8	Đ

What is the sequence of visit of the salesman, so that the cost is minimum?

(b) Use the method of Lagrangian multipliers to solve the following non-LP problem. Does the solution maximize or minimize the objective function? **07**

Optimize $Z = 2x_1^2 + x_2^2 + 3x_3^2 + 10x_1 + 8x_2 + 8x_3 - 100$

Subject to the constraint

$g(x) = x_1 + x_2 + x_3 = 20$

and $x_1, x_2, x_3 \geq 0$

OR

Q.5 **(a)** Solve the non-linear programming problem using Kuhn-Tucker method : **07**

Maximize $Z = 4x_1 - x_1^3 + 2x_2$

Subject to $x_1 + x_2 \leq 1$

$x_1, x_2 \geq 0$

(b) When n = k + 1 solve the problem **07**

Minimize $Z_x = 7x_1x_2^{-1} + 3x_2x_3^{-2} + 5x_1^{-1}x_2x_3 + x_1x_2x_3$

and $x_1, x_2, x_3 \geq 0$ by geometric programming method.

****