Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE – SEMESTER – VIII.EXAMINATION – WINTER 2016

Subject Code: 180503 Date: 21/10/2016

Subject Name: Process Simulation & Optimization

Time: 02:30 PM to 05:00 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)** Maximize $f = 6x_1 + 5x_2$, subject to : $2x_1 + 5x_2 \leq 20$, $-5x_1 - x_2 \leq -5$, $-3x_1 - 11x_2 \leq -33$ using Simplex method. (Show 3 simplex table) **07**

(b) Suppose the foods listed below have calories, protein, calcium, vitamin A and cost per 100 gm as shown. In what amounts should these foods be catered to soldiers to meet at least the daily requirements listed while minimizing the total cost. **07**

	Bread	Meat	Potatoes	Cabbage	Milk	Gel	Required
Calories	1254	1457	318	46	309	1725	3000
Protein	39	73	8	4	16	43	70
Calcium	418	41	42	141	536	0	800
Vitamin A	0	0	70	860	720	0	500
Cost	30	100	5	8	23	48	

Q.2 **(a)** Trace the path using Path Tracing Method for a set of the following equations in functional form : $f_1(x_1,x_2)=0$, $f_2(x_4)=0$, $f_3(x_3,x_6)=0$, $f_4(x_4,x_5)=0$, $f_5(x_1,x_6)=0$, $f_6(x_2,x_3,x_5)=0$ **07**

(b) Explain six steps used to solve optimization problem. **07**

OR

(b) Explain obstacles to optimization. **07**

Q.3 **(a)** Explain the evaluation of nature of convexity by examining the eigen values of multivariable function and determine the convexity of function $f(x) = -2x_1^2 + 3x_1x_2 - 2x_2^2$. **07**

(b) Explain following terms : Partitioning, Tearing, Precedence ordering, Boolean matrix **07**

OR

Q.3 **(a)** State the necessary and sufficient conditions for a minimum or maximum of function of single variable and determine extremum of $f(x) = x^5$. **07**

(b) Explain the algorithm of Steepest Descent method for unconstrained multivariable optimization problem. **07**

Q.4 **(a)** Minimize $f(x) = x^4 - x + 1$ using Newton's method for a starting point of x=0.6422 (Show 3 iterations). **07**

(b) Explain briefly 'Sequential Modular Approach'. **07**

OR

Q.4 **(a)** Minimize function $f(x) = x / (1 + x^2)$ using Golden section method. Start with initial interval = (-0.6, 0.75) **07**

(b) Apply Lagrange Multipliers method to minimize $f(x) = 4x_1^2 + 5x_2^2$ subject to constraint : $2x_1 + 3x_2 - 6 = 0$ **07**

Q.5 **(a)** Explain fitting of VLE data by Non linear regression. **07**

(b) Derive the equation for optimum pipe diameter. **07**

OR

Q.5 **(a)** State objective functions in terms of the adjustable variable for chemical reactor. **07**

(b) Obtain an objective function to minimize total cost with respect to the working fluid temperature in optimizing recovery of waste heat. **07**

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