

GUJARAT TECHNOLOGICAL UNIVERSITY**BE SEM-VIII Examination May 2012****Subject code: 180503****Subject Name: Process Simulation & Optimization****Date : 14/05/2012****Time: 10.30 am – 01.00 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) What is Optimization? List the six general steps for the analysis and solution of optimization problems. **07**
- (b) Discuss the degree of freedom analysis with suitable example. **07**
- Q.2** (a) Explain the attributes of the process affecting costs/profits make them attractive for the application of optimization. **07**
- (b) What is simulation? Explain linear system analysis. **07**
- OR**
- (b) Discuss essential feature of optimization problem. **07**
- Q.3** (a) Attempt All
- 1) A box with a square base and open top is to hold 1000cm^3 . Find the dimensions that require the least material (assume uniform thickness of material) to construct the box. **04**
- 2) Find the largest area of the largest rectangle with its lower base on the x axis and whose corners are bounded at the top by the curve $y = 10 - x^2$ **03**
- (b) List out the important model building steps for a process. **07**
- OR**
- Q.3** (a) Explain partitioning and tearing with example. **07**
- (b) Discuss precedence ordering. Also write any one algorithm for precedence ordering. **07**
- Q.4** (a) The analysis of labor costs involved in the fabrication of heat exchangers can be used to predict the cost of a new exchanger of the same class. Let the cost be expressed as a linear equation. **07**

$$C = \beta_1 + \beta_2 A + \beta_3 N$$

Where β_1 , β_2 , and β_3 are constants, N=number of tubes, A=shell surface area. Estimate the values of the constants β_1 , β_2 and β_3 from the data in following table.

Labor cost (\$)	Area (A)	Number of tubes (N)
310	120	550
300	130	600
275	108	520
250	110	420
220	84	400
200	90	300
190	80	230
150	55	120
140	64	190
100	50	100

- (b) Minimize $f = (x-1)^4$ via Newton's method, starting at $x_0 = -1.5$. 07
- OR**
- Q.4 (a) Explain Simultaneous modular approach in simulation 07
 (b) Explain equation oriented mode in simulation. 07
- Q.5 (a) Minimize the following function using simplex method of linear programming. 08

$$f = -x_1 - 2x_2 - x_3$$
 Subject to constraints,

$$2x_1 + x_2 - x_3 \leq 2$$

$$2x_1 - x_2 + 5x_3 \leq 0$$

$$4x_1 + x_2 + x_3 \leq 0$$

$$x_i \geq 0, \quad i = 1 \text{ to } 3$$
- (b) Determine convexity or concavity for the following functions. 06
 1) $f(x) = 2x_1 + 8x_2 + 6$
 2) $f(x) = 2x_1^2 + 2x_1x_2 + 1.8x_2^2 + 7x_1 + 8x_2 + 24$
- OR**
- Q.5 (a) Explain Sequential modular approach for simulation 07
 (b) Explain simulation techniques for the solution of ordinary differential equation. 07
