

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-VIII (NEW) - EXAMINATION – SUMMER 2017****Subject Code: 2180503****Date: 02/05/2017****Subject Name: Process Modeling, Simulation & Optimization****Time: 10:30 AM to 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.

MARKS

- Q.1 Short Questions 14**
- 1 Explain degrees of freedom.
 - 2 Write the conditions for a stationary point to be an extremum.
 - 3 Classify the methods to solve unconstrained multivariable problems.
 - 4 Explain primal-dual relationship in LP Problem.
 - 5 Define process modeling.
 - 6 List the various tearing algorithms.
 - 7 Give name of two static and two dynamic simulators.
- Q.2 (a) List the applications of optimization in chemical process engineering. 03**
- (b) An open rectangular box with square base is to be made from 48 ft² of material. What dimensions will result in a box with the largest possible volume? 04**
- (c) Explain the six steps for solving optimization problems. List the general obstacles to solve optimization problems. 07**
- OR**
- (c) Explain the steps for finding the optimum L/D ratio for a pressurized cylindrical storage vessel. List all the variables and the important assumptions. 07**
- Q.3 (a) Find the values of x and z (both > 0) that maximize the function: 03**
 $U = -x^2 + 10x + xz - z^2 + 8z + 2$
- (b) Explain Random search and grid search method for unconstrained multivariable optimization. 04**
- (c) Fit the exponential curve $y = ae^{bx}$ to following data: 07**
- | | | | | |
|---|----|----|----|----|
| x | 2 | 4 | 6 | 8 |
| y | 25 | 38 | 56 | 84 |
- OR**
- Q.3 (a) Minimize the quadratic function $f(x) = x^2 - x$ by Secant method. Use the range of -3 to +3. 03**
- (b) Determine whether the function is convex or concave. 04**
 $f(x) = 4x_1^2 + 3x_2^2 + 5x_3^2 + 6x_1x_2 + x_1x_3 - 3x_1 - 2x_2 + 15$
- (c) Solve the following Linear Programming Problem. 07**

Maximize $Z = 5x_1 + 3x_2$

subject to:

$$x_1 + x_2 \leq 2$$

$$5x_1 + 2x_2 \leq 10$$

$$3x_1 + 8x_2 \leq 12$$

$$x_1, x_2 \geq 0$$

- Q.4** (a) What are the various equations of motion for process modeling? **03**
(b) Explain black box model. **04**
(c) Give a detail classification of models. **07**

OR

- Q.4** (a) Differentiate between deterministic and stochastic models. **03**
(b) Write a note on the transport equations used for modeling. **04**
(c) Determine the mathematical model for isothermal CSTR with constant hold-up. **07**

- Q.5** (a) List the various equations for chemical kinetics used in modeling. **03**
(b) Develop a batch reactor model. **04**
(c) What is sequential modular approach? Explain the steps with diagram. **07**

OR

- Q.5** (a) Explain equation solving approach in brief. **03**
(b) Write short note on decomposition of networks. **04**
(c) Describe any one chemical process simulator and its salient features. **07**
