

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-VIII • EXAMINATION – SUMMER 2013****Subject Code: 180405****Date: 09/05/2013****Subject Name: Modeling and Simulations of Bioprocess****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.
4. Abbreviations have conventional meaning.

- Q.1 (a)** Write a note on: Obstacles to Optimization **06**
- (b)** Optimize the total area of a dryer employed for downstream operations of a bioproduct. It is designed to contain 300cm^2 of drying area with margins provided to the total area with 6 cm at top and bottom and 4cm at each side. **04**
- (c)** Enlist the attributes of optimization processes. **04**
- Q.2 (a)** With the help of suitable example explain segregated model of product formation. **07**
- (b)** Classify models giving fundamental characteristics of each. **07**
- OR**
- (b)** Develop a model for CSTR with assumptions. Correlate the parameters and variable through suitable equations. **07**
- Q.3 (a)** A company manufactures two types of cloth, using three different colours of wool. One yard length of type A cloth requires 4 gram of red wool, 5 gram of green wool and 3 gram of yellow wool. One yard length of type B cloth requires 5 gram of red wool, 2 gram of green wool and 8 gram of yellow wool. The wool available for manufacture is 1000 gram of red wool, 1000 gram of green wool and 1200 gram of yellow wool. The manufacturer can make profit of Rs.5 on one yard of type A cloth and Rs.3 on one yard of type B cloth. Find the best combination of the quantities of type A and type B cloth which gives him maximum profit. Formulate the L.P.P. first and solve it graphically. **10**
- (b)** For each of these functions, analyze if the given function is convex or concave. **04**
 $f(x) = 4x^3$, $f(x) = 6x^2 - x^3$, $f(x) = 8x$, $f(x) = -2x^2$,
- OR**
- Q.3 (a)** Define linear programming. Enlist its uses in the field. **04**
- (b)** Mention all variables for the development of model for activated sludge digestion. Derive design equations governing all parameters. **10**
- Q.4 (a)** Bacterial growth follows given equation for animal cells concentration. Find an optimal solution by computing all basic solutions and then finding one that maximizes the objective function using simplex method. **07**
 $2x_1 + 3x_2 - x_3 + 4x_4 = 8$, $x_1 - 2x_2 + 6x_3 - 7x_4 = -3$, $x_1, x_2, x_3 \geq 0$
 Maximize $z = 2x_1 + 3x_2 + 4x_3 + 7x_4$
- (b)** Write the concept of genetic algorithm and compare it with artificial neural network. **07**
- OR**
- Q.4 (a)** *Zyduz Biotech* produces product Q10, which sells in grams at a rate of P grams per day. The cost per gram produced is $C = 50 + 0.1P + 9000/P$ in Rupees/gram. The selling price per gram is Rs. 300/-. Determine: **07**
 The production level giving the minimum cost per gram.
 The production level which maximizes the profit per day.
 The production level at zero profit.

- Q.4 (b)** Apply golden section search until four iterations to find out the optimal for $f(x) = x^3 - 20$ correct to four decimals. **07**
- Q.5 (a)** Draw the flow chart for Euler's Method **05**
- (b)** Find y for $x=0.1$ by Euler's Method. Given: $dy/dx = (y-x) / (y+x)$
 $y(0)=1$ **05**
- (c)** Explain how structured model is better than unstructured model. **04**
- OR**
- Q.5 (a)** What is compartment model? Explain a two compartment model. **07**
- (b)** By Newton's method find the real root of the equation : **07**
 $3x = \cos x + 1$ correct to four decimal places.
