



Name :

Roll No. :

Invigilator's Signature :

CS/B.TECH (BIO-TECH.)/SEM-7/BT-703C/2012-13

2012

MODELLING AND SIMULATION OF BIOPROCESSES

Time Allotted : 3 Hours

Full Marks : 70

The figures in the margin indicate full marks.

*Candidates are required to give their answers in their own words
as far as practicable.*

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following :

10 × 1 = 10

- i) Shu's model used for lactic acid fermentation is
 - a) segregated
 - b) unsegregated
 - c) unstructured
 - d) all of these.
- ii) Leudeking-Piret model used for
 - a) production kinetics
 - b) substrate utilization kinetics
 - c) growth kinetics
 - d) none of these.



iii) The Monod model is

- a) structured
- b) unstructured
- c) segregated
- d) dynamic.

iv) Leudeking-Piret model is

- a) growth associated model
- b) non-growth associated model
- c) growth as well as non-growth associated model
- d) none of these.

v) Equation based strategy is

- a) SPEED UP
- b) ASCEND
- c) FLOWSIM
- d) all of these.

vi) Programme based strategy is

- a) Euler's methods
- b) Newton-Raphson methods
- c) Runge-Kutta methods
- d) all of these.



vii) Growth associated constant depends on

- a) substrate concentration
- b) temperature
- c) pH
- d) all of these.

viii) Aiba model is

- a) substrate non-inhibitory model
- b) substrate inhibitory model
- c) product inhibitory model
- d) all of these.

ix) Logistic model is

- a) inhibitory model than Monod model
- b) non-inhibitory model than Monod model
- c) segregated model
- d) dynamic model.



- x) Kano & Asai model is used for
- a) substrate utilization kinetics
 - b) product formation kinetics
 - c) growth kinetics
 - d) all of these.
- xi) The Monod model predicts that the specific growth rate
- a) will increase with the concentration of growth limiting substrate until it reaches a maximum value
 - b) will decrease with the concentration of growth limiting substrate
 - c) will increase with the concentration of growth limiting substrate
 - d) does not depend on growth limiting substrate.

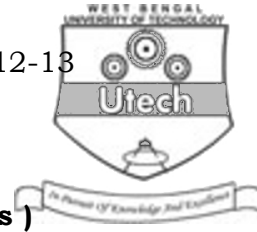


GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following $3 \times 5 = 15$

2. Explain the product inhibition on the product formation.
3. Describe the application of Runge-Kutta method on bioprocess simulation.
4. Describe the effect of pH on specific growth rate and specific production rate through competitive inhibition model.
5. Describe thermal sterilization of the medium through Stochastic model.
6. Describe the anaerobic digestion through COSSU's model.
7. Describe the different substrate inhibitory unstructured kinetic models.
8. Describe different unstructured models for activated sludge process.

**GROUP – C****(Long Answer Type Questions)**

Answer any *three* of the following. $3 \times 15 = 45$

9. In a fermentation process Rapamycin was produced through aerobic process. The experiment was carried out at pH - 6.8 and 30°C. The following data was found after successfully fermentation process.

Substrate concentration (g/l)	Specific growth rate (l/h)
0.50	0.25
0.75	0.33
1.00	0.39
1.50	0.47
2.00	0.50
2.50	0.51
3.00	0.51
3.50	0.50

It is assumed that substrate is growth limiting substrate and product Rapamycin does not have any inhibitory effect on microbial growth. Find out the kinetic parameters of Monod and Andrew's Model with simulated curve and experimental curve.

8 + 7



10. a) Describe Arrhenius Plot for the calculation of activation energy and its importance.
- b) Derive an expression for effect of temperature on specific growth rate and specific production rate.
- c) Describe the effect of temperature on Yield coefficient ($Y_{x/s}$) and maintenance coefficient (m). 6 + 4 + 5
11. Give brief notes on structured models for growth and product formation of lactic acid. 8 + 7
12. Give brief notes on unstructured kinetic models for microbial growth and product formation of lactic acid. 8 + 7
13. Write short notes on any *five* of the following : 5 × 3
- a) Unstructured modelling
 - b) Structured modelling
 - c) Deterministic models
 - d) Stochastic models
 - e) Segregated models
 - f) Unsegregated models
 - g) Compartmental models
 - h) Genetically structured models.

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