KUMARAGURU
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Register Number:……..

B.TECH DEGREE EXAMINATIONS: NOV/DEC 2014

(Regulation 2009)

Sixth Semester

BIOTECHNOLOGY

BTY118: Bioprocess Engineering

Time: Three Hours **Maximum Marks: 100**

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. During Continuous sterilization, the holding section is kept under ----------condition
   a) adiabatic b) isothermal
   c) non-adiabatic d) Non-isothermal
2. A plot of ln (N_t/N_0) Vs time is called _____
   a) Survival curve b) Death curve
   c) Del curve d) Decimal reduction cure
3. Bubble column rely on gas sparging for _____
   a) Agitation b) Liquid flow
   c) Gas flow d) Energy efficiency
4. In the given bioreactor, the diameter of the impeller is 20 m. The impeller size is 90 % of the tank diameter. The impeller is rotated at a speed of 100rpm.Then, the impeller tip speed is
   a) 1017136 b) 6280
   c) 561200 d) 5652
5. A 10 L bioreactor is scale-up to 10,000 L, then scale-up factor is
   a) 1000 b) 0.1
   c) 10 d) 9990
6. K_L can be measured by sulphite oxidation method. The DO concentration measured by dissolved oxygen probe in sodium sulphite solution will be
   a) High b) Low
   c) Zero d) No change

7. Plasmid cells are maintained at constant, maximal growth of 0.693 h^{-1} during scale-up from shake flask through seed fermentation into production. The total fermentation time is 25 h. The no. of generation is --------

a) 50 b) 5

c) 25 d) Insufficient data

8. Low copy number plasmids have specific mechanism to their _____ distribution and High copy number plasmids are _____ distribution ,respectively

a) randomly, equal b) equal, equal

c) equal, random d) both have uneven

9. The alteration of more than a single gene to enhance the flow of metabolites through an entire pathway is referred to as

a) Genetic Engineering b) Mutation studies

c) Metabolic Engineering d) Gene regulation studies

10. Application of single cell model approach is

a) cell geometry b) Molecular level

c) transient response d) All the above

PART B (10 x 2 = 20 Marks)

11. What are the salient features that are considered in the design of bioreactors?
12. Define the following.
    (i) Dispersion Coefficient
    (ii) Dispersion Number
13. What are the roles of disengagement zone in airlift reactor?
14. Write the expression for σ^2 (dimensionless variance) in terms of Peclet number.
15. List out the disadvantages of sulphite oxidation method.
16. On scaling up, it is mathematically absurd to get identical conditions in all terms in the scaled up reactor compared to the base reactor. Give mathematical explanation for the above fact.
17. Calculate the solubility of pure oxygen at 20 °C.
18. Write the factors influencing for segregation loss of plasmid.
19. Compare the advantages of unstructured and structured models used in bioprocess engineering.
20. List any two structured models represent the cell mass formation.

PART C (5 x 14 = 70 Marks)

21. a) A continuous culture system is being constructed and the size of the

fermentation tank is 50,000 litres and the residence time is 2 hours. The unsterilized medium contains 10^4 spores/ litre. The volume of the specific death rate has been determined as 1 min^{-1} at 121°C and 61 min^{-1} at 140°C. For each of the temperature, determine the required residence time in the holding section, so as to ensure that 99% of the sterilization of the time for a 4 weeks continuous operation, that can be obtained without contamination.

(OR)

b) Describe the two models available for predicating the non-ideal flow behavior in bioreactor.

22. a) The dynamic method is used to measure K_La in a fermenter operated at 30°C. Data for dissolved-oxygen concentration as a function of time during the re-oxygenation step is as follows:

Time (s)	10	15	20	30	40	50	70	100	120
Air saturation (%)	43.5	53.5	60.0	67.5	70.5	72.0	73.0	73.5	73.5

The equilibrium concentration of oxygen in the broth is 7.9 * 10^{-3} kg m^{-3}. Determine K_La.

(OR)

b) Derive the equation for scale up of a bioreactor using the following criteria.

(i) Constant power per unit volume

(ii) Constant K_La

(iii) Constant impeller tip speed

23. a) Discuss in detail about the on-line and off –line estimation of biomass in the broth.

(OR)

b) With an example, explain in detail about Flow Injection Analysis (FIA).

24. a) Explain in detail about modeling of recombinant batch cultures.

(OR)

b) With a neat diagram, discuss in detail about the various host - vector systems available in r-DNA technology.

25. a) Discuss in detail the structured models for cell growth and product formation.

(OR)

b) Write detailed account on:

(i) Single cell model (7)

(ii) Compartmental model (7)

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