H 1335

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2006.

Sixth Semester

Industrial Bio-Technology

IB 342 — BIOPROCESS ENGINEERING

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Write the advantages and disadvantages of column fermenter.

2. What is meant by structured segregated model?

3. What are the limitations of sulphite oxidation method of determining k_La?

4. Write two parameters that influence the gas holdup in bioreactors.

5. Write the substrate feeding equation in fedbatch culture (assume monod model).

6. What are the advantages of plant cell culture?

7. Define Power number.

8. What are the advantages of two stage chemostat?

9. How will you maintain plasmid stability in the fed batch cultivation?

10. For obtaining stationary phase culture batch cultivation is preferred than continuous cultivation state the reason.

PART B — (5 × 16 = 80 marks)

11. Write about the various resistances in transfer of oxygen from gas bubble to the cell. State which resistance will be the limiting factor for oxygen transfer in high viscous fermentation like xanthan gum production and cell pellet formation such as citric acid production.

12. (a) Write short notes on :

(i) Microbial calorimetry and its applications

(ii) Various analytical techniques used for biomass estimation (Both online and offline).

Or

(b) Write short notes on

(i) airlift reactor

(ii) cell recycle continuous stirred tank fermenter.

13. (a) Write the advantages and disadvantages of expressing recombinant proteins in E.coli, Bacillus, Saccharomyces cerevisiae and animal cell culture.

Or

(b) Explain the growth kinetics of recombinant microorganism with plasmid instability. A plasmid containing strain of E.coli is used to produce recombinant protein in a 250 litre fermenter. The probability of plasmid loss per generation is 0.005. The specific growth rate of plasmid free cells is 1.4 l/h. Estimate the fraction of plasmid bearing cells after 18 h growth if the inoculum contain only cells with plasmid.

14. (a) Write about the environmental requirements for animal cell culture and discuss about the different type of reactors used for animal cell culture.

Or

(b) Write briefly about the structured modelling in bioprocessing. Write the general procedure for building kinetic models in bioprocess.

15. (a) Medium at a flow rate of 2 m^3/h is to be sterlised by heat exchange with steam in a continuous sterliser. The liquid contains bacterial spores at a concentration of 5×10^{12} per m^3; the activation energy and Arrhenius constant for thermal destruction of these contaminants are 283 kj/gmol and 5.7×10^{39} l/h respectively. A contamination risk of one organism surviving every 60 days operation is considered acceptable. The sterliser pipe has an inner diameter of 0.1 m; the length of the holding section is 24 m. The density of the medium is 1000 kg/m^3 and the viscosity is 3.6 kg/m/h. The axial dispersion coefficient at this flow rate is 16.6 m^2/h and the Damkohler number is 42. Explain the procedure for continuous sterliser design. Calculate the del factor and sterlising temperature required. Gas constant R is 8.3144 J/k/gmol.

Or

(b) Write short notes on the following :

(i) Flow injection analysis

(ii) Computer based data acquisition.
