Exam.Code:0909
Sub. Code: 6708

1078
B.E. (Biotechnology)
Fifth Semester
BIO-512: Bio-Process Engineering

Time allowed: 3 Hours Max. Marks: 50

NOTE: *Attempt five questions in all, including Question No. 1 which is compulsory and selecting two questions from each Unit. Make suitable assumptions wherever necessary.*

x-x-x

I. Answer the following:-

a) Give reasons for the deterioration of medium quality during heat sterilization.

b) Discuss how does oxygen transfer takes place in culture flasks?

c) Define aseptic operation and containment.

d) Describe the consequences of using an undefined media.

e) Explain the phenomena of wash-out in chemostat.

f) Obtain an expression for cell-concentration in continuous culture as a function of time.

g) Discuss the concept of repeated fed-batch culture.

h) Deduce the expression for Power law.

i) What are pneumatically agitated reactors?

j) Give reasons for foaming during fermentations. (10x1)

UNIT – I

II. a) Define a Rheogram. Explain the major points of comparison between the Newtonian and non-Newtonian fluids with relevant examples.

b) Give a brief account on the structured and unstructured models. (6,4)

III. A batch culture is started by inoculating 12 g of cells into a 100-lilre bubble column fermenter containing 100 g L^{-1} glucose. The culture does not exhibit a lag phase. The maximum specific growth rate of the cells is 0.9 h^{-1}; the biomass yield from glucose is 0.575 g g^{-1}. Estimate the time required to reach stationary phase. What will be the final cell density if the fermentation is stopped after only 85% of the substrate is consumed? (10)

P.T.O.

IV. List main factors involved in scale-up and scale-down. Discuss the suitability of constant P/V and constant k_La approaches for a scale-up of shear sensitive culture.. Discuss how sterilization process is scale dependent. Justify how it results in the decrease in the yield of fermentation because of nutrient degradation. (10)

UNIT – II

V. The number of viable spores of a new strain of *Bacillus subtilis* is measured as a function of time at various temperatures. The values for death rate constant at these temperatures are k_d (85°C) = 0.012 min^{-1}; k_d (90°C) = 0.032 min^{-1}; kd (110°C) = 1.60 Min^{-1}; k_d (120°C)= 9.61 min^{-1};

a) Determine the activation energy for the thermal death of spores.
b) What is the specific death rate constant at 100° C?
c) Estimate the time required to kill 99% of spores in a sample at 100° C? (10)

VI. Discuss why the oxygen-balance method is the most desirable method for k_La assessment in spite of huge initial investment. Include relevant expressions and plots to explain its merits and demerits. (10)

VII. a) Give reasons for foaming during fermentations. Enlist desirable features for a substance to be used as ideal antifoam.

b) Outline the major considerations for developing SIP and CIP facilities in a fermentation industry. (5,5)

x-x-x