R09

Code No: C5105

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M.Tech I Semester Examinations March/April-2011
BIO-PROCESS ENGINEERING
(CHEMICAL ENGINEERING)

Time: 3hours **Max.Marks:60**

Answer any five questions
All questions carry equal marks
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1) With a help of neat labeled sketch, explain the principle of a repeated fed-batch system and show that quasi steady state,
$X^t = X^t_0 + FYx/s\ S_0$. Where X^t= biomass amount, X^t_0 = initial biomass amount, Yx/s = yield coefficient, S_0 = substrate concentration of sterile feed. [12]

2) The following data is available for the plant cell culture operated in a continues mode.

Biomass produced (g/L)	1	1	1	1	1
Substrate consumed (g/L)	1.2	1.8	2.4	3.0	3.4
Dilution rate (hr-1)	1	2	3	4	5

Calculate the death rate constant (Kd) and maintenance co-efficient of cells. [12]

3) Explain the following
a) Energy capture efficiency.
b) Oxygen consumption and heat evolution in aerobic cultures.
c) Heat generation and yield factor estimation. [12]

4) Derive expression for scale up criteria used in bioreactors scale up based on constant K_La constant power input per unit volume and constant impeller tip speed. [12]

5) Explain with neat diagram, the working principle of different type of sensors used inn bioreactors to measure pH and dissolved oxygen. [12]

6) Discuss the following:
a) M.M equation.
b) Line Weaver Bruk plot.
c) Eadif Hofstee plot. [12]

7) Explain Response Surface Method for design of a good commercial fermentation medium. [12]

8) A steam sterilizer is used to sterilize liquid medium for fermentation. The initial concentration of contaminating organisms is 10^8 per liter. For design purpose, the final acceptable level of contamination is usually taken to be 10^3 cells; this corresponds to a risk that one batch in thousand will remain contaminated even after sterilization process is complete. For how long should $1m^3$ medium be treated if the temperature is (i) 80°C, (ii) 121°C, (iii) 140°C? For the spores the activation energy for thermal death is 283 KJ/g.mol and the Arrhenius constant is $10^{36}\ S^{-1}$. [12]

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