

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

- - -

- 1) With a help of neat labeled sketch, explain the principle of a repeated fed-batch system and show that quasi steady state,
 $X^t = X_0 + FY_{x/s} S_0$. Where X^t = biomass amount, X_0 = initial biomass amount, $Y_{x/s}$ = yield coefficient, S_0 = substrate concentration of sterile feed. [12]
- 2) The following data is available for the plant cell culture operated in a continous 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
- Energy capture efficiency.
 - Oxygen consumption and heat evolution in aerobic cultures.
 - Heat generation and yield factor estimation. [12]
- 4) Derive expression for scale up criteria used in bioreactors scale up based on constant $K_L a$ 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:
- M.M equation.
 - Line Weaver Bruk plot.
 - 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) $80^\circ C$, (ii) $121^\circ C$, (iii) $140^\circ C$? For the spores the activation energy for thermal death is 283 KJ/g.mol and the Arrhenius constant is 10^{36} S^{-1} . [12]

* * * * *