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B.E. / B.TECH. DEGREE EXAMINATIONS, DEC 2019

Seventh Semester

CH16703 – BIOCHEMICAL ENGINEERING*(Chemical Engineering)***(Regulation 2016)****Time: Three Hours****Maximum : 100 Marks**Answer **ALL** questions**PART A - (10 X 2 = 20 Marks)**

		CO	RBT
1.	Compare the role of cells and enzymes in manufacture of biochemical products.	1	U
2.	Classify fungi with an example of an industrially important fungus belonging to each of these categories.	1	U
3.	Define enzyme activity and its unit.	2	R
4.	Describe the proximity and orientation effects on enzyme action with a sketch.	2	U
5.	Sketch the most commonly observed growth rate of microbial cells as a function of substrate concentration.	2	U
6.	Derive an expression for decimal reduction time for sterilization.	2	AP
7.	What are the factors that influence the oxygen transfer rate in a fermenter?	3	U
8.	What is the commonly used dimension and position of a flat blade turbine in a bioreactor of internal diameter D and height H?	3	AP
9.	State methods used for improving filtration rate while recovery of suspended insoluble products from a bioprocess.	4	AP
10.	Define extractive fermentation with an example.	4	AP

PART B - (5 X16 = 80 Marks)

11. (a) Describe the classification and structure of industrially important microbial strains. For each class of microbe give an example with the product synthesized by the microorganism. **(16)**

(OR)

- (b) With a process flowsheets, demonstrate the role of chemical engineers in Bioprocess industry with large scale production of ethanol and Baker's yeast as case study. (16) 1 U
12. (a) (i) Discuss the effect of different class of inhibitors on enzyme reactions with a simple mechanism, corresponding modified Michaelis- Menten rate equation and example. (10) 2 U
- (ii) Write a note on effect of temperature and pH on activity of enzymes. (6) 2 U
- (OR)**
- (b) (i) Derive the kinetics of surface immobilized enzymes and illustrate the role of external mass transfer resistance on the rate of the reaction. (10) 2 U
- (ii) List and sketch configurations of bioreactors used for immobilized enzyme bioreactors. (6) 2 U
13. (a) What are the various essential constituents (ingredients) and requirements of growth medium for industrial bioprocesses? Write a brief note on formulation of medium based on stoichiometry of the biological process. (16) 2 AP
- (OR)**
- (b) (i) Derive expressions for steady state concentration of biomass, substrate and product formation for a chemostat. (8) 2 AP
- (ii) Using the expressions derived determine the steady state concentration of the substrate, biomass and product for formation of lactic acid from glucose in a continuous culture by *Streptococcus lactis* in a stirred tank reactor of volume 20 m³ when the feed rate is 1.5 m³/hr. The following information is obtained from experimental studies: $S_0 = 5 \text{ g/l}$, $\mu_m = 0.2 \text{ h}^{-1}$, $K_S = 200 \text{ mg/l}$, $Y_{x/s} = 0.4 \text{ g X/g S}$, $Y_{p/s} = 0.2 \text{ g X/g S}$, $q_P = 0.1 \text{ g P/g X - h}$. (8) 2 AP

14. (a) (i) Write the significance of volumetric oxygen transfer coefficient(K_La) and factors that influence it. (4) 3 U
- (ii) Elaborate on the methods for the determination of K_La and list the advantages and disadvantages of each of these methods. (12) 3 U

(OR)

- (b) (i) List and sketch the various heat transfer equipments and configurations for bioreactors used to improve the heat transfer rate. State their comparative advantages and disadvantages. (8) 3 U
- (ii) Write a note on correlations used in determining the heat transfer coefficients for a stirred tank reactor. (8) 3 U

15. (a) Write a brief note on various unit operations used in separation of bacterial and fungal mycelia from fermentation broth and their selection criteria. (16) 4 AP

(OR)

- (b) What are the key steps in recovery and purification of an intracellular product? Explain different unit operations employed under each of these steps in downstream processing with specific examples. (16) 4 AP