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**M.E. / M.TECH. DEGREE EXAMINATIONS, MAY 2019**

Second Semester

**CL18010 – BIOPROCESS ENGINEERING***(Chemical Engineering)***(Regulation 2018)****Time: Three Hours****Maximum : 100 Marks**

Answer ALL questions

**PART A - (10 X 2 = 20 Marks)**

1. Define microbial oxygen demand.
2. Define cell recycle cultivation
3. Name any four polymers used in enzyme immobilization.
4. Compare the role of enzymes and cells in the manufacture of a biochemical product.
5. What are the effects of scale up?
6. What should be the value of impeller Reynolds number for laminar and turbulent regime in a bioreactor?
7. Name the factors that determine the bioreactor performance.
8. Write the importance of Thiele Modulus.
9. Cost of bioseparations for intracellular products is higher than extracellular products. Justify!
10. List in order the key steps involved in recovery and purification of an extracellular secondary metabolite synthesized by an industrial bioprocess.

**PART B - (5 X16 = 80 Marks)**

11. (a) (i) What is immobilization of enzymes? What are its advantages over free enzymes? (8)  
(ii) What is meant by critical oxygen concentration and its significance with respect to cell growth? (8)

**(OR)**

- (b) Derive design equation for CSTR for continuous cultivation of cells and also explain Monod kinetics. (16)

12. (a) (i) What is dilution rate? Discuss the effect of dilution rate on biomass and (10)  
substrate concentrations?

(ii) Write a note on simple product formation kinetics. (6)

**(OR)**

(b) (i) Explain in detail about any two immobilization techniques. (8)

(ii) Compare and contrast the various methods of immobilization. (8)

13. (a) Derive the expression for power requirement in an aerated bioreactor and in (16)  
ungassed bioreactors.

**(OR)**

(b) How will you design the packed bed reactor for immobilized enzyme reaction? (16)

14. (a) Explain in detail about the growth kinetics with plasmid instability in batch (16)  
culture.

**(OR)**

(b) How  $k_{La}$  depends on bioreactor operating conditions such as the stirrer speed, (16)  
power input, gas flow rate, and liquid properties such as viscosity.

15. (a) Describe the working principle of gel permeation chromatography with its (16)  
application in recovery and purification of bioprocess industry.

**(OR)**

(b) Describe in detail about various cell disruption methods. (16)