

B.Tech. Seventh Semester (Biotechnology) (C.B.S.) -  
**Bioprocess and Equipment Design**

P. Pages : 1

Time : Three Hours



**TKN/KS/16/7962**

Max. Marks : 80

- Notes :
1. All questions carry equal marks.
  2. Answer **any five** questions.
  3. Assume suitable data wherever necessary.
  4. Illustrate your answers wherever necessary with the help of neat sketches.

1. a) Write in detail about designing of fluidized bed reactor. Explain critical parameter used while designing fluidized bed reactor along with their design equation. **10**  
b) Estimate the minimum height of the space above the fluidized bed having static bed height 30 mm. Value of Reynolds Number and Fluidization number is 110 and 55 respectively. **6**
2. a) Explain the design of packed distillation column on the basis of height of transfer unit concept. **8**  
b) Explain the compartmental model for cell growth. **8**
3. Explain the design of a bracket support and a skirt support. **16**
4. a) What are different types of agitator? Explain the Anchor agitator with neat sketch. **8**  
b) What is safe reinforcement limit of the nozzle? Explain Area for Area method for safe compensation of a nozzle. **8**
5. a) Discuss the engineering aspects of scale up for chromatography systems. **8**  
b) Kerosene is to be cooled from 71°C to 50°C. Flow rate of Kerosene is 30kg/sec. How large an air cooler would be required for this service. The design dry bulb temperature of air is 35°C. correction factor for LMTD is 0.97. **8**  
Overall heat transfer coefficient for Kerosene air cooler can be assumed as  $300 \text{ w/m}^2 \cdot \text{K}$ .  
Specific heat of Kerosene =  $2150 \text{ J/kg} \cdot \text{K}$ .
6. a) Consider the scale up of fermentation from a 10 : 1 to 10000 : 1 vessel. The small fermenter has a height to diameter ratio of 3. The impeller diameter is 30% of the tank diameter. Agitator speed is 500 rpm and three Rushton impellers are used. Determine the dimensions of the large fermenter and agitator speed for constant P/V method of scale up. **8**  
b) Discuss the various protective coating in bioreactor. **8**
7. Write short notes on : **16**  
a) Stability analysis of bioreactors.  
b) Design of heat exchange equipments.
8. a) Explain the principle, mechanism and theory of corrosion along with its different forms. **10**  
b) Describe some characteristic features of a fermenter which are needed to be considered while designing. **6**

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