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2007 JAWAHARLAL NEHRUTECHNOLOGICAL UNIVERSITY

II B.TECH I SEMESTER REGULAR EXAMINATIONS TRANSPORT PHENOMENA IN BIOPROCESS (BIO-TECHNOLOGY)

SET NO-1
NOVEMBER 2007

TIME: 3 HOURS
MARKS: 80

Answer any FIVE Questions
All Questions carry equal marks

1. (a) What are the different parameters effecting the convective mass transport.
(b) Explain the mass transfer process .
(c) Define interfacial area. [8+6+2]
2. (a) Mention the different phases between which the mass transfer takes place.
(b) Write the equation to determine the liquid mass transfer flux.
(c) Write the equation to determine the mass transfer flux through gas film.
(d) Write the units of concentration. [4+5+5+2]
3. In an aerobic fermentation process, the typical average bubble diameter is 3 mm, with an average raise velocity of 18 cm/s. If the diffusivity coefficient is $8 \times 10^{-10} \text{m}^2/\text{s}$. Find the mass transfer coefficient on the basis of penetration theory. [16]
4. (a) Define power number and explain each term .
(b) Define impeller Reynolds number and explain each term .
(c) Define Froude number. What is its significance. [6+5+5]
5. (a) What are impellers, why are they used. Mention some important type of impellers with figures.
(b) Sketch the following baffle arrangements [8+8]
 - i. Baffle set away from wall and at an angle for high viscosity liquids
 - ii. Baffles attached to the wall for low viscosity liquids.
6. Explain the role of shear in stirred fermenters . [16]
7. A hot flue gas at 800C is flowing through a composite spherical shell formed by two spheres having inner, middle and the outer radius as 10cm , 15cm, and 20cm. Thermal conductivity of inner shell = 38 w/m0C Thermal conductivity of outer shell = 45 w/m0C Film coefficient of heat transfer at the outer surface of composite spherical shell is 10w/m2 0C. Ambient air temperature is 280C. Calculate the rate of

heat flow through the wall of composite spherical shell and the temperature at the inner surface, at the interface and at the outer surface. [16]

8. (a) *Write a general form of correlation to predict heat transfer coefficient*

(b) *Write equations for dimensionless numbers in the above equation.*

(c) *What is the significance of Nusselt number, Reynolds number, Prandtl number and Grashof number.*

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