Code: R7312301

B.Tech III Year I Semester (R07) Supplementary Examinations, May 2012

TRANSPORT PHENOMENA IN BIO PROCESSES

(Biotechnology)

Time: 3 hours   Max Marks: 80

Answer any FIVE questions

All questions carry equal marks

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1 (a) Give a brief account on Non-Newtonian fluids.
   (b) Describe the different factors effecting broth viscosity.

2 (a) A fermentation broth with viscosity 10^{-2} Pa s and density 1000 Kg m^{-3} is agitated in 50 m^3 baffled tank using a marine propeller 1.3 m is diameter. Calculate the power required for a stirrer speed of 4 S^{-1}. The tank is fitted with four baffles. (Power number versus Reynolds number graph should be provided during the examination)
   (b) Explain about interface transport in isothermal system.

3 (a) The temperature at the inside surface of a hollow silver sphere is 85^0 C and the outside surface, 15^0 C. The inside diameter is 5 cm and the outside diameter is 7.5 cm. The value of K of silver ils 425 W/mK. Find the rate of hear flow.
   (b) In what way are Newton's law of viscosity and Fourier's law of heat conduction similar? Dis similar.

4 A 400 x 400 mm copper slab 5 mm thick at a uniform temperature of 250^0 C suddenly has its surface temperature lowered to 30^0 C. Find the time at which the slab temperature becomes 90^0 C. p = 9000 Kg/m^3, c = 0.38 KJ/Kg^0 K, k = 370 W/m^{0}K, h= 90 W/m^{20}K. All terms with usual notations.

5 (a) Explain in detail about two film theory with neat sketch.
   (b) Determine the diffusivity of CO through a mixture of N$_2$ and O$_2$ in which the concentration of CO is essentially zero. The gas mixture will be at 25^0 C and 2 atm pressure. Other data: D$_{CO-O_2}$ = 0.185 $\frac{cm^2}{s}$ at 273^0 K, 1 atm: D $_{CO-N_2}$ = 0.192 $\frac{cm^2}{s}$ at 288^0 K.

6 Solvent A is evaporating out of a coat of lacquer on a plane surface exposed to a tangential stream of non-condensable gas B. At a given point on the surface the gas phase mass transfer coefficient at the prevailing average fluid properties is given as 0.1 Ib-mole/hr ft^2; the Schmidt number is = 2.0. The interfacial gas composition is X$_{AO}$ = 0.8. Estimate the local rate of evaporation using the stagnant film model.

7 Calculate the maximum rate of absorption of O$_2$ in a fermenter from air bubbles at 1 atm abs pressure having diameters of 100 μm at 37^0 C into water having a zero concentration of dissolved O$_2$. The solubility of O$_2$ from air in water at 37^0 C is 2.26 x10^{-4} Kgmol O$_2$/m^{-3}. The diffusivity of O$_2$ in water at 37^0 C is 3.25 x 10^{-9} m^2/s. Agitation is used to produce the air bubbles.

8 (a) Explain briefly about how oxygen mass transfer and k$_L$a can limit the biomass density in ferementors.
   (b) Explain briefly about the dynamic method for the estimation of mass transfer coefficient.

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