Code :R7312301

$\boxed{\textbf{R7}}$

III B.Tech I Semester(R07) Supplementary Examinations, May 2011
TRANSPORT PHENOMENA IN BIOPROCESSES
(Biotechnology)

Time: 3 hours

Max Marks: 80

Answer any FIVE questions
All questions carry equal marks
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1. (a) Explain briefly about turbulent flow with emphasis on time smoothed velocity distributions in turbulent flow
   (b) Describe the different factors effecting broth viscosity.

2. (a) Name the important dimensionless numbers & their physical significance which are used for the calculation of power during mixing operation.
   (b) Write the equation of continuity for one dimensional isothermal incompressible fluids.
   (c) Describe about different operating conditions for turbulent shear damage.

3. (a) In what way are Newton's law of viscosity and Fourier's law of heat conduction similar? Dis-similar?
   (b) Food cold storage room is to be constructed of an inner layer of 19.1 mm of pine wood, a middle layer of cork board and an outer layer of 50.8 mm of concrete. The inside wall surface temperature is -17.8^0C and the outside surface temperature is 29.4^0C at the concrete surface. The mean conductivities are for pine 0.151, cork 0.033 and concrete 0.762 W/mK. The total inside surface area of the room to use in the calculation is 39 m^2. What thickness of cork board is needed to keep the heat loss to 586 W?

4. (a) 400 X 400mm copper slab 5mm thick at a uniform temperature of 250^0C suddenly has its surface temperature lowered to 30^0C. Find the time at which the slab temperature becomes 90^0C. ρ=9000 Kg/m^3, c=0.38KJ/Kg ^{0}K, k=370W/m ^{0}K, h=90W/m^2 ^{0}K. All terms with usual notations.
   (b) What do you understand about semi-infinite solid?

5. (a) Explain the rate of diffusion in bio-processing.
   (b) Explain film theory with neat sketch.

6. (a) How are the mass transfer coefficients affected by high mass transfer rates across the interface?
   (b) In an aerobic fermentation process, the typical average bubble diameter 3mm, with an average raise velocity of 18cm/s. If the diffusivity coefficient is 8 X 10^{-10}m^2/s, find the mass transfer coefficient on the basis of the penetration theory.

7. What are the various correlations for evaluating mass transfer coefficients and interfacial area for gas-liquid transfer?

8. (a) What are the factors that will be affecting oxygen transfer rate?
   (b) Explain how K_L a is measured by using Oxygen balance method.

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