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CM-7005(1)-CBGS

B.E. VII Semester

Examination, December 2020

Choice Based Grading System (CBGS)

Transport Phenomena

Time : Three Hours

Maximum Marks : 70

Note: i) Attempt any five questions.
ii) All questions carry equal marks.

1. a) Compute the heat loss/m^2 from a 40 cm thick furnace wall whose either side surface temperature were maintained at 50 to 300 °C. The thermal conductivity of material is given by
$K = 0.005T - 5 \times 10^{-6} T^2$ (T is in °C)
b) Determine the variation of viscosity of CO_2 as temperature was varied from 100 to 400, with a unit change of 100 in each step and 1 atm using kinetic theory of gases.

2. Derive the expression of diffusion through a cylindrical shell of radius r_1 hanging in large mass of air. Assume the cylindrical section $r = r_2$. Assume the temperature is function of r radially in the non-isothermal film as shown

$$\frac{T}{T_1} = \left(\frac{r}{r_1}\right)^n$$, where T_1 is the temperature at $r = r_1$.

3. A plastic resin is in a vertical cylindrical vessel of radius R, which is rotating about its own axis at a constant angular velocity Ω. The height of liquid in the vessel is z_R. Determine the shape of the free surface.

4. a) Gas A diffuses through the cylindrical wall of a plastic tube. As it diffuses, it reacts at a rate R. Find the appropriate differential equation for this system.
   b) An industrial pipeline containing ammonia gas is vented to the atmosphere (a3-mm-tube is inserted into the pipe and extends for 20 m into the air). If the system is at 25ºC find the mass rate of ammonia lost from vent.

5. Attempt any one from the following:
   a) Can be Navier Stokes equation applicable for turbulence, if yes, how?
   b) What are Reynolds stresses? Write the expression for them?

6. Write unsteady state and steady state macroscopic mechanical energy balance and describe each terms involved in it. How is the integral term in the balanced evaluated and under what specific situation it is difficult to evaluate the integral. Discuss.

7. Describe the convective flow transport phenomena in a room with both side of walls maintained at different temperatures. Use appropriate assumption to derive to the fluid flow calculations.

8. Explain the following theories:
   i) Bonssineq's eddy viscosity
   ii) Prandtl's mixing length
   iii) Von Karman's similarity Hypothesis.

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