

(Following Paper ID and Roll No. to be filled in your Answer Books)

Paper ID : 2289921

Roll No.

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B.TECH.

Regular Theory Examination (Odd Sem-IV) 2016-17

TRANSPORT PHENOMENA

Time : 3 Hours

Max. Marks : 100

Section - A

1. Attempt all parts. All parts carry equal marks. Write answer of each part in short. (10×2=20)
- What are the differential driving forces for momentum, heat and mass transports?
 - Write Fourier's law of heat conduction in 3-dimensional form.
 - Write Fick's law of diffusion in 3-dimensional form?
 - How does thermal conductivity of gas vary with temperature and pressure?
 - How does diffusivity of gas vary with temperature and pressure?
 - How does viscosity of liquid vary with temperature and pressure?
 - Write physical significance of Reynolds number.
 - Write physical significance of prandtl number.

- What is Newton's law of viscosity?
- Differentiate between absolute viscosity and kinematic viscosity.

Section - B

Note : Attempt any five questions from this section. (5×10=50)

- A horizontal annulus is 27 ft. long. The outside radius of inner cylinder is 0.49 inch, the inner radius of outer cylinder 1.1 inch. A 60% of aqueous solution of sucrose is to be pumped through the annulus at 20°C. At this temperature the fluid density is 80.3 lb/ft³ and its viscosity is 136.8 lbm/ft hr. What is the volume rate flow when the impressed pressure drop is 5.39 psi.
- A copper wire has radius of 2 mm and length of 5 m For what voltage drop would the temperature rise at the wire axis be 10°C, if the surface temperature of wire is 20°C? For copper, the Lorenty No. is 2.23×10^{-3} Volt²/K²
- Derive an expression for heat conduction through composite walls.
- What do you understand by cooling fin, explain? Also discuss various types of cooling fins.
- The diffusivity of gas pair oxygen- carbon tetra chloride is determined by observing the steady state evaporation of CCl_4 in to a tube containing O_2 . The distance between the CCl_4 liquid level and the top of the tube is 17.1 cm. the total pressure on the system is 755 mm Hg and the temperature is 0°C the vapour pressure of CCl_4 at that

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temperature is 33 mm Hg. The cross sectional area of the diffusion tube is 0.82 cm^2 . It is found that 0.0208 cm^3 of CCl_4 evaporate in 10 hour period after steady state has been attained. What is the diffusivity of the gas pair $\text{CCl}_4\text{-O}_2$?

7. Derive continuity equation for a fluid in rectangular coordinate system. Also write suitable boundary conditions for momentum balance equation.
8.
 - i) Discuss the term "Diffusion control chemical reactions".
 - ii) Define effectiveness factor for porous catalysts.
9. Differentiate between free and forced convection. Also define and give the physical significance of various dimensionless numbers involved in these operations.

Section - C

Note : Attempt any two questions from this section.
(2×15=30)

10. Derive an expression for velocity distribution for a flow through a circular tube. Also find the maximum and average velocities.
11. Develop an expression for heat conduction with a viscous heat source. Also discuss the significance of Brinkman number.
12. Derive equation of motion in Cartesian coordinates and notify the various terms.