



SE-7321

B. E. - IV (Chemical) (Sem. VII) Examination

April / May - 2011

Transport Phenomena

Time : 3 Hours]

[Total Marks : 100

**Instruction :**

(1)

नीचे दृष्टावेक निशानीवाणी विगतो उत्तरवही पर अवश्य कभवी. Fillup strictly the details of signs on your answer book.	Seat No. :
Name of the Examination :	<input type="text"/>
<input type="text" value="B. E. - 4 (CHEMICAL) (SEM. 7)"/>	<input type="text"/>
Name of the Subject :	<input type="text"/>
<input type="text" value="TRANSPORT PHENOMENA"/>	<input type="text"/>
Subject Code No. : <input type="text" value="7"/> <input type="text" value="3"/> <input type="text" value="2"/> <input type="text" value="1"/>	<input type="text" value="Student's Signature"/>
Section No. (1, 2,.....) : <input type="text" value="NIL"/>	

- (2) Answer each section in separate answerbook.  
(3) Figures to the right indicate full marks.  
(4) Assume appropriate data if necessary and mention it clearly.  
(5) Symbols used have conventional meaning.
- 1 (a) Explain the advantages of dimensional analysis. 5  
(b) Explain how the equation of continuity and the equation of motion can be jointly utilized for obtaining velocity profiles for fluid flow problems. 5  
(c) Derive the equation for velocity profile and volumetric flow rate for laminar flow of a Newtonian fluid through an annulus. 8
- 2 Answer any two : 8×2=16  
(a) Derive Buckingham-Reiner equation.  
(b) Derive an equation for flow through a horizontal pipe for a fluid fitting the Bingham fluid.  
(c) Derive the equation of continuity which can describe the concentration profiles for binary diffusion system of two components 'A' and 'B'. Consider density and diffusivity of both constants.
- 3 Answer any two : 8×2=16  
(a) Derive an equation for velocity distribution for flow of fluid near a wall suddenly set in motion from rest for unsteady state condition. Show the results graphically.

- (b) Derive the equation of energy in rectangular co-ordinates.
- (c) Derive the equation for the velocity distribution for the liquid flowing downward on outside surface of circular tube under laminar flow conditions.
- 4 (a) Answer the following : **5×2=10**
- (1) Define Fin effectiveness and write down the equation for the same by mentioning all the terms.
  - (2) Write down Chapman-Enskog equation for diffusivity.
  - (3) What is the effect of temperature on thermal conductivity of liquid and gases ?
  - (4) Kinematic viscosity in momentum transfer is analogous to \_\_\_\_\_ in heat transfer. Give its unit.
  - (5) What is Brinkman number ? State its importance.
- (b) Derive the equation for heat flow at the structure **1×8=8** for heat conduction with an electrical heat source in electric cylindrical wire of circular cross-section with radius R and electrical conductivity  $K_e$ .
- 5 Attempt any two : **8×2=16**
- (1) Derive the theoretical equation for thermal conductivity of monatomic gases at low density using kinetic theory of gases. State the assumptions made.
  - (b) Derive equations for temperature profile for heat conduction with nuclear heat source.
  - (c) For laminar free convection flow between two vertical plates at two different temperatures, determine the average, velocity of upward moving air stream for following conditions :  
 Pressure : 1 atmosphere  
 Temperature of heated wall : 100°C  
 Temperature of cooled wall : 20°C  
 Spacing between the walls : 0.6 cm.
- 6 Attempt any two : **8×2=16**
- (1) Derive an equation to calculate the rate of mass transfer at the liquid - gas interface for the use of a diffusion through stagnant gas film. State the assumptions made.
  - (2) Derive an equation for effectiveness of fins.
  - (3) Use shell mass balance, derive equation for the rate of mass transfer at gas - liquid interface for diffusion with homogeneous chemical reaction.