

**TRANSPORT PHENOMENA**  
**END TERM PAPER**  
**SESSION-2016-17**

G.N. - Bi 5071  
TP

**Total Pages—4**

**(Set-V<sub>1</sub>)**

**B. Tech - 4th(M & M)**  
**Transport Phenomena**

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**Full Marks : 70**

**Time : 3 hours**

**Answer six questions including Q. No. 1**  
**which is compulsory**

*The figures in the right-hand margin indicate marks*

**Symbols carry usual meaning**

**1. Answer all questions : 2 × 10**

**(a) Briefly explain the significance of Reynolds number.**

**(b) State the Bernoulli's principle along with the mathematical expression.**

**(c) Briefly explain the significance of Fick's laws.**

**(d) Briefly mention the significance of different Biot's number.**

47  
1.6  
63

**( Turn Over )**

- (e) What is friction factor?
  - (f) Briefly explain Navier Stokes equation.
  - (g) What is Stefan Boltzmann law?
  - (h) Differentiate between Newtonian and Non-Newtonian fluid.
  - (i) Briefly explain the significance of Grashof number.
  - (j) What is emissivity? Give examples of matter at the extreme end of emissivity.
2. (a) Derive an expression for pressure drop in an incompressible Newtonian fluid in laminar flow, flowing through a cylindrical pipe of constant cross-section. 5
- (b) Derive an expression for velocity distribution for the flow of fluid between two fixed plates. 5
3. (a) Water is flowing between two parallel plates under a pressure 1 psi. Calculate the shear

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stress at the plate wall, if the plates are 1 inch apart and are 10 ft. long. Assume viscosity of water as 1 cp.

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(b) With the help of mathematical expression differentiate between heat transfer and mass transfer through a hollow cylinder.

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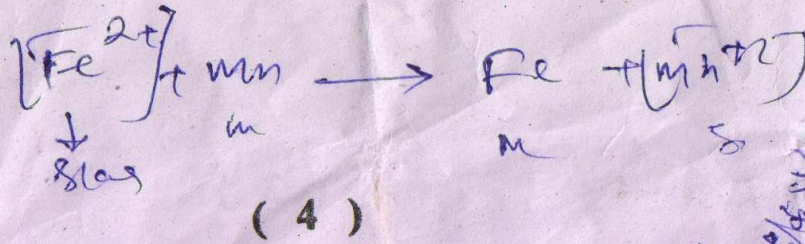
4. (a) Briefly explain the steady state one dimensional mass transfer through a stationary media.

5

(b) Differentiate between homogeneous and heterogeneous reaction. Which one is more important from metallurgy point of view and why?

5

5. A steel tube ( $K = 43 \text{ W/m.k}$ ) of outside diameter 7.3 cm and thickness 1.3 cm is covered with an insulating material ( $K = 0.2 \text{ W/m.K}$ ) of thickness 2 cm on its outside surface. The steel tube is used to carry a hot gas at  $330^\circ\text{C}$  with convective heat transfer coefficient  $200 \text{ W/m}^2\text{.K}$ . The outside insulator is exposed to ambient air at  $30^\circ\text{C}$



with convective heat transfer co-efficient  $50 \text{ W/m}^2 \cdot \text{K}$ . Calculate the following :

- (i) Heat loss to air from a 10 m long tube
  - (ii) Temperature drop ( $\Delta T$ ) across steel tube and insulating layer. 10
6. (a) What is a lump system? 2
- (b) Derive the expression for unsteady heat transfer by lumped analysis system. 5
- (c) Mention the validity criteria for lumped capacitance method. 3
7. (a) Briefly explain the nucleation, growth and bubble formation phenomenon. 5
- (b) Explain the mechanism of slag interfacial reaction. 5
8. Write short notes on any two : 5 × 2
- (i) Kirchoff's law of thermal radiation
  - (ii) Buckingham's  $\pi$  theorem
  - (iii) Convective heat transfer
  - (iv) Interfacial reaction.