



Name : .....  
Roll No. : .....  
Invigilator's Signature : .....

**CS/B.Tech (BT-OLD)/SEM-4/CHE-414/2013**

**2013**

**TRANSFER OPERATION - I**

Time Allotted : 3 Hours

Full Marks : 70

*The figures in the margin indicate full marks.*

*Candidates are required to give their answers in their own words  
as far as practicable.*

**GROUP – A**

**( Objective Type Questions )**

1. Choose the correct alternatives for any *ten* of the following :

$$10 \times 1 = 10$$

- i) What is potential flow ?
- ii) What is meant by cavitation within a pump ?
- iii) Which of the following device is used to measure the flow rate of any fluid ?
  - a) Target meter
  - b) Rotameter
  - c) Vortex – shedding meter
  - d) All of these
  - e) None of these.
- iv) What is equivalent diameter ?

- 4209 (O)



- xiii) What is LMTD ?
- xiv) Thermal diffusivity is expressed as
- $K / (\rho C_p)$
  - $K / (\rho C_p \mu)$
  - $K \cdot C_p / \rho$

### GROUP – B

#### ( Short Answer Type Questions )

Answer any *three* of the following.  $3 \times 5 = 15$

- If  $\Delta P = \phi (D, L, u, \rho, \mu)$ . Now by dimensional analysis show that variables are related as follows  

$$\Delta P = f (L/D, Du\rho / \mu)$$
- A sharp edged orifice, connected to a manometer, is used for measuring the flow rate of brine ( specific gravity = 1.2 ) flowing through a 12.7 mm ID pipe. The maximum flow rate does not exceed 700 lt/min and the maximum manometer reading does not to exceed 400 mm Hg. Calculate the size of the orifice.
- Deduce the Bernoulli equation for a flowing fluid without fluid friction.
- Write short note on any *one* of the following :
  - belt conveyor
  - ball mill



6. a) State Kick's law.
- b) Calculate the power required in hp to crush  $150 \times 10^3$  kg of feed, if 80 % of the feed passes through 2.5 inches screen and 80% of the product passes through 1/8 inches screen (Bond's law constant,  $K_b = 4.784$ )      2 + 3
7. a) Give the classification of pump.
- b) What is the working function of a pump.
- c) Give an example for measuring local velocity of fluid flowing phenomena with the mathematical expression for determination of local velocity 'u'.      2 + 1 + 2

**GROUP – C**

**( Long Answer Type Questions )**

Answer any *three* of the following.       $3 \times 15 = 45$

8. a) Briefly discuss about fluidized bed and the conditions of fluidization.
- b) What are the different types fluidization ?
- c) What is minimum fluidization velocity ?
- d) Give the expressions for minimum fluidization velocity.
- e) What are applications of fluidization.      8 + 3 + 1 + 2 + 1



9. Compare between venturi meter and orifice meter in all the aspects. A pump draws a solution of specific gravity 1.84 from a storage tank through a 3 inches (75 mm) pipe. The efficiency of the pump is 60 %. The velocity in the suction line is 3 ft/s (0.914 m/s). The pump discharges through a 2 inches (50 mm) pipe to an overhead tank. The end of the discharge pipe is 50 ft (15.2 m) above the level of the solution in the feed tank. Frictional losses in the entire piping system are 10 ft. lbf/lb (29.9 J/kg). What pressure must the pump develop ? What is the power delivered to the fluid by the pump ?

6 + 9

10. a) Define couette flow.
- b) Deduce Hagen-Poiseuille equation for laminar flow of Newtonian fluid and state its significance.
- c) What are the influences of solid boundary wall ? Briefly discuss about rheological behavior of different kinds of Newtonian and non-newtonian fluids.

2 + (6 + 1) + (1 + 5)



11. a) Show that in steady state conductive heat flow through a series of layers the overall resistance equals the sum of the individual resistances of each layer.
- b) A flat furnace wall is constructed of a 4.5 inches refractory brick with a thermal conductivity of 0.08 Btu/ft.h. °F backed by 9 inches layer of common brick, of conductivity 0.8 Btu/ft.h. °F. The temperature of the inner face of the wall is 1400 °F and that of outer face is 170 °F.
- i) What is the heat loss through the wall.
- ii) What is the temperature of the interface between refractory brick and the common brick ?
- iii) Supposing that the contact between the two brick layers is poor and that a contact resistance of  $0.5 \text{ °F.h.ft}^2/\text{Btu}$  is present, what would be the heat loss ?
- c) What is dirt factor ? 5 + 9 + 1



12. a) A Slurry containing of 0.2 kg of solid (specific gravity = 3) per kg of water is fed to a rotary drum filter of 0.6 m long and 0.6 m in dia. The drum rotates at 1 revolution in 6 minutes and 20% of the filtering surface is in contact with the slurry at any instant. If filtrate is produced at the rate of 0.45 ton/hr and the cake has voidage of 0.5, what thickness of cake is produced when filtering with a pressure difference of  $65 \text{ KN/m}^2$ .
- b) Discuss about advantages and disadvantages of rotary drum filter. 10 + 5
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