Enroll No. _____

Shree Manibhai Virani and Smt. Navalben Virani Science College (Autonomous)

Affiliated to Saurashtra University, Rajkot

SEMESTER END EXAMINATION NOVEMBER – 2016

M.Sc. Industrial Chemistry

16PICCC02 - INDUSTRIAL UNIT OPERATIONS

Duration of Exam – 3 hrs ***Semester – I*** ***Max. Marks – 70***

***Part A** (5x2= 10 marks)*

Answer **ALL** questions

1 Define Distillation with example.

2 What is Equilibrium and Bound moisture?

3 Enlist any two industrial unit operations in which calculated heat transfer is desired.

4 Define:
   i. Free convection
   ii. Forced convection

5 State Stefan-Boltzman law. Give its mathematical expression.

***Part B** (5X5 = 25 marks)*

Answer **ALL** questions

6a Explain HETP for continuous contact equipment used in gas absorption.

OR

6b Discuss factors affecting choice of solvent for liquid extraction.

7a What is filter aid? Explain characteristics of filter medium.

OR

7b Derive an equation for cross circulation drying.

8a Define with example the following:
   i. Heat transfer
   ii. Conduction mode
   iii. Convection mode
   iv. Radiation mode
   v. Thermal insulator

OR

8b State and derive equation for Fourier's law of heat conduction

9a Enlist any four applications of finned surfaces. Draw any three types of fins used in industries.

OR

9b Derive an equation for heat transfer considering extreme cases for extended surfaces.

10a Write a note on regenerator and recuperator type of heat exchangers.

OR

10b Explain parallel flow type shell and tube heat exchanger with diagram.

Part C (5X7 = 35 marks)

Answer **ALL** questions

11a Explain steps involved in multistage counter current extraction to find out the theoretical stages required.

OR

11b Derive an equation of q line using Mc Cabe Thiele method.

12a Derive equations for both constant and falling rate period of drying.

OR

12b Explain centrifuge filtration with schematic diagram.

13a The wall of refrigerator consist of 1.5mm of steel sheet at an outer surface 10 mmm plywood at an inner surface and 2cm of glass wool in between.
The temperature of the inside and outside surface is -15^{o}C and 25 ^{o}C.
The values of thermal conductivity (k) for steel, glass wool & plywood is 23.2, 0.014 and 0.052 W/(m.K) respectively.
Calculate:

i) The rate of heat flow per unit area.
ii) The temperature at the two interfaces.

OR

13b The combustion chamber of an oil furnace wall is constructed with following dimensions:
X_1 = 0.05 m K_1 = 0.12 W/(m.K)
X_2 = 0.15 m K_2 = 0.15 W/(m.K)
X_3 = 0.02 m K_3 = 50.0 W/(m.K)
Temperature of hot gas is 760^{o}C and that of outside air is 25 ^{o}C.
Calculate:

i) The rate of heat transfer per unit area.
ii) The temperature at the two interfaces.

14a Write a detailed note on drop wise condensation.

OR

14b Write a detailed note on film wise condensation.

15a Explain in detail design of shell and tube heat exchanger.

OR

15b Write a note on correction factors and heat exchanger effectiveness.