

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

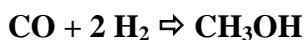
Affiliated to Saurashtra University, Rajkot

**SEMESTER END EXAMINATION NOVEMBER – 2016****M.Sc. Industrial Chemistry****16PICCC01 - INDUSTRIAL STOICHIOMETRY & MOMENTUM TRANSFER OPERATION***Duration of Exam – 3 hrs**Semester – I**Max. Marks – 70***Part A (5x2= 10 marks)**Answer **ALL** questions

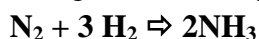
- 1 Define: i) Yield ii) Excess reactant
- 2 What is Stoichiometry?
- 3 Draw a labeled diagram of Boundary Layer. Give its Definition.
- 4 What is dimensional homogeneity? Give one example.
- 5 Define slugging with example.

**Part B (5X5 = 25 marks)**Answer **ALL** questions

- 6a CO is reacted with H<sub>2</sub> to produce methanol. Calculate Stoichiometry ratio of H<sub>2</sub> to CO, kmole of methanol produced per kmole of CO reacted, weight ratio of CO to H<sub>2</sub>, quantity of CO required to produce 100 kg of methanol.

**OR**

- 6b Ammonia is produced by following reaction. Calculate the molar flow rate of H<sub>2</sub> if the feed rate of N<sub>2</sub> is 25 kmole/hr. Also calculate kg of ammonia produced if the % conversion is 25.



- 7a A dilute acid containing 25% H<sub>2</sub>SO<sub>4</sub> is concentrated using commercial H<sub>2</sub>SO<sub>4</sub> containing 98% H<sub>2</sub>SO<sub>4</sub> to obtain a desired acid containing 65% H<sub>2</sub>SO<sub>4</sub>. Find the quantities of dilute acid and commercial acid required to make 1000 kg of desired acid.

**OR**

- 7b 2000 kg of wet solid containing 70% solid are fed to a tray drier where it is dried by hot air. The product obtained contains 1% moisture. Calculate kg of water removed and kg of product obtained.

- 8a Explain construction and working of a reciprocating pump with a neat diagram.

**OR**

- 8b Explain construction and working of a centrifugal pump with a neat diagram.

- 9a Explain steps involved for the application of Buckingham method.

**OR**

- 9b Discuss minimum and critical velocity for fluidization.

10a Explain types of fluidization in detail.

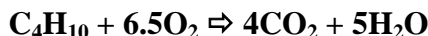
**OR**

10b Explain various forces involved in movements of fluid with their formulae.

**Part C (5X7 = 35 marks)**

Answer **ALL** questions

11a A combustion reactor fed with 50 kmole of butane and 2100 kmole/hr of air. Calculate % of excess air required.



**OR**

11b A stream of carbon dioxide flowing at a rate of 100 kmol/ min is heated from 290 °C to 383 °C. Calculate the heat that must be transferred using Cp data.

Gas	a	b	c	d
CO <sub>2</sub>	21.365	64.2841 x 10 <sup>-3</sup>	-41.050 x 10 <sup>-6</sup>	9.799x 10 <sup>-9</sup>

12a The groundnut seeds containing 45% oil and 45% solids are to be fed to expeller, the cake coming out of expeller is found to contain 80% solids and 5% oil. Find out the percentage recovery of oil.

**OR**

12b The feed to a continuous fractionating column analysed by weight 28 % benzene and 72% toluene. The analysis of the distillate shows 52 % benzene and 5 weight % benzene was found in the bottom product. Calculate the amount of distillate and bottom product per 1000 kg of feed per hour. Also calculate the percent recovery of benzene.

13a Explain in detail construction and working of a Venturimeter with a neat diagram. Give its advantages and disadvantages.

**OR**

13b Explain in detail construction and working of a Orifice meter with a neat diagram. Give its advantages and disadvantages.

14a Using heat transfer coefficient(h), show that  $N_{Nu}$  is the function of  $N_{Re}$  and  $N_{Pr}$  with the help of Rayleigh method.

**OR**

14b With the help of dimensional analysis, write the fundamental and derived quantities along with their units.

15a Derive an equation of terminal settling velocity for spherical particles having Newton's range.

**OR**

15b A bed containing 32700 kg of sand is to be fluidized having 0.0145 cm diameter and the air of density 0.557 lb/ft. Fluidization is carried out in cylindrical vessel of diameter 10 ft. Density of sand particles is 1.68 lb/ft, viscosity of air is  $2.15 \times 10^{-6}$  lb/ft.sec. If the final porosity of the fluidized bed is 0.55. Calculate the final height of bed, pressure drop, Minimum velocity and Critical velocity (Take initial porosity zero and  $g = 9.8 \text{ m/sec}^2$ )