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Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Fourth semester B.Tech examinations (S), September 2020

Course Code: FT202
Course Name: PRINCIPLES OF CHEMICAL ENGINEERING (FT)

Max. Marks: 100

Duration: 3 Hours

PART A
Answer any three full questions, each question carries 10 marks.

Marks

1 a) Discuss how food technology is related to chemical engineering (5)

   b) Discuss with examples unit operations and unit processes (5)

2 An aqueous solution of sodium carbonate containing 15 % carbonate by weight.80 % of the carbonate is removed as $Na_2CO_3.10 H_2O$ by evaporation of water and subsequent cooling at 278 K. The solubility of $Na_2CO_3.10 H_2O$ is 9 % by weight. On the basis of 100 kg of solution determine the quantity of crystals formed and amount of water evaporated. (10)

3 Propane is burnt with excess of air to ensure complete combustion. If 50kg of CO_2 and 20 kg CO are obtained when propane is completely burnt with 550kg air. Determine i) Mass of propane burnt in kg ii) %excess air iii) Composition of flue gas. Molecular weight of air = 29 (10)

4 a) Define the terms Orsat, ultimate, proximate methods of analysis. (5)

   b) Sulphur is burned in dry air, the gas leaving the burner contains SO_2- 15 %, O2 - 5 %, and N_2- 80 %. Determine the sulphur used. (5)

PART B
Answer any three full questions, each question carries 10 marks.

5 a) Use the enthalpies of combustion for the burning of CO_2 (g), H_2 (g) and C(s) to determine ΔH^o for the reaction : $C(s) + H_2O (g) \rightarrow H_2 (g) + CO (g)$

   (1) $CO (g) + \frac{1}{2} O_2 (g) \rightarrow CO_2 (g)$ $\Delta H = -238$ KJ/mol

   (2) $H_2 (g) + \frac{1}{2} O_2 (g) \rightarrow H_2O (g)$ $\Delta H = -241$ KJ/mol

   (5)

   (3) $C(s) + O_2 (g) \rightarrow CO_2 (g)$ $\Delta H = -393$ KJ/mol

   b) State and explain i) Kopp's rule

                           ii) Trouton's rule (5)

6 1 kg of water is heated from 250K to 400 K at standard atmospheric pressure.

		How much heat is required for the change if the mean heat capacity of ice between 250K and 273 K is 2.03KJ/Kg K and that of water between 273K and 373 K is 75.726 KJ/Kg K.? The heat capacity of water vapour is given as $C_p = 30.475 + 9.652 \times 10^{-3} T + 1.189 \times 10^{-6} T^2$ KJ/Kmol K. ΔH_f and ΔH_v are 6012 KJ/Kmol K and 40608 KJ/Kmol K respectively.	(10)
7		What is meant by rheology of fluids? Explain the classification of fluids on the basis of Newton's law of viscosity	(10)
8	a)	With a neat schematic explain the method of calculation of pressure drop using a Differential manometer.	(5)
	b)	Explain the Reynold's experiment to determine the nature of flowing fluid through a pipe.	(5)

PART C
Answer any four full questions, each question carries 10 marks.

9		What is Fanning Friction factor? Derive the fanning equation to find out the pressure drop due to friction in a pipe for a turbulent flow.	(10)
10		Derive the Hagen-Poiseuille equation for finding out the pressure drop in pipe	(10)
11	a)	Explain the characteristic curves of a centrifugal Pump	(5)
	b)	Write short notes on (i) Air priming (ii) NPSH (iii) Cavitation in centrifugal Pumps.	(5)
12		Explain the working of single acting and double acting reciprocating Pump.	(10)
13		Describe the working and derive the flowrate equation for an orifice meter	(10)
14		Explain the effect of superficial velocity on pressure drop and bed height during fluidization	(10)

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