Seat No. _____ Enrollment No. _____

THE CHARUTAR VIDYA MANDAL UNIVERSITY

M.Sc. Industrial Chemistry) – SEMESTER 2

SUMMER 2023 (REGULAR) EXAMINATION

Course Title: Unit Processes

Course Code: 201310203

Total Printed Pages : 02

Date: 17/04/2023 **Time: 10.00 am to 12.00 pm** **Maximum Marks: 50**

Instructions:

- Attempt all questions.
- Numbers to the right indicate full marks for each question.
- Make suitable assumptions wherever necessary.

Q. 1 Answer the following multiple choice questions. **(04)**

(i) A reaction occurs between benzene and 50% HNO_3 containing 0.2 molar $Hg(NO_3)_2$ which yields up to 85% dinitro-phenol and picric acid is known as:

a. Oxidation **b.** Sulfonation
c. Nitrosation **d.** Oxynitration

(ii) During alcoholysis a tertiary alcohol will _____ a primary alcohol.

a. Not replace **b.** Acidify
c. Replace **d.** None

(iii) In mercaptans, the alkyl group is bound to:

a. Nitrogen **b.** Oxygen
c. Sulphur **d.** Fluorine

(iv) The principle disadvantages of nitric acid as a _____ agent arises from the tendency to act as a Nitrating agent.

a. Sulfonating agent **b.** Partial oxidizing agent
c. Nitrating agent **d.** Hydrolysing agent

Q.2 Attempt **any three** of the following. **(06)**

(i) Write the advantages of the batch process compared to continuous processes.

(ii) Elaborate the esterification by Ketene.

(iii) Describe Tubular Reactor used in alkylation with diagram.

Q.3 **(a)** Write the manufacturing process with schematic diagram for m-Dinitrobenzene. **(05)**

(b) Describe the construction, working and safety measures of batch nitrator **(05)**

OR

(b) Describe the Liquid phase nitration. **(05)**

Q.4	**(a)**	Explain the reactors used in esterifying process with suitable diagram.	**(05)**
	(b)	Write a note on Catalytic esterification	**(05)**
		OR	
	(b)	What is hydrolysis? Elaborate different hydrolyzing agent used for hydrolysis.	**(05)**
Q.5	**(a)**	Write a note on alkylating agent.	**(05)**
	(b)	Describe the types of alkylated compounds.	**(05)**
		OR	
	(b)	Describe various reactors used in alkylation with suitable diagram.	**(05)**
Q.6	**(a)**	Write a note on oxidizing agent.	**(05)**
	(b)	Describe the synthesis of hydrocarbons from CO and H_2.	**(05)**
		OR	
	(b)	Elaborate Methanol production by using synthesis gas with schematic diagram.	**(05)**

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Seat No. _____ Enrolment No. _____

THE CHARUTAR VIDYA MANDAL UNIVERSITY

M.Sc. (Industrial Chemistry) Semester-2
April 2023 Examination

Course Title: Heat Transfer Operations and Stoichiometry
Course Code: 201310204
Total Printed Pages : 02
Date: 19/04/2023 **Time: 10.00 am to 12.00 noon** **Maximum Marks: 50**

Instructions:
- Attempt all questions.
- Numbers to the right indicate full marks for each question.

Q. 1 **Answer the following multiple choice questions.** **[04]**

1. An insulator should have_____.
   a. High thermal conductivity b. Low thermal conductivity
   c. Less resistance to heat flow d. None of the above
2. McAdams equation is used for _____flow.
   a. Parallel b. Non-Laminar c. Counter current d. Laminar
3. Fouling factor depend on_____.
   a. Length of fins b. Thickness of fins
   c. Scales formed d. Density of cold fluid
4. Formula of a component involved in chemical reaction is known as_____.
   a. Limiting co-efficient b. Stoichiometric co-efficient
   c. Excess co-efficient d. Mole ratio

Q.2 **Answer the following questions to the point.** **[06]**

1. Write the statement of Newton's law of convective heat transfer?
2. What are the effects of heat transfer rate in different flow region?
3. Define the terms: % Selectivity, Limiting reactant

Q. 3 (a) With neat diagram derive equation for heat flow through cylindrical surface. **[05]**

(b) Determine the heat transfer coefficient of pipe wherein water is pumped at 90000 kg/hr at 60^0C temperature. A pipe of 0.02m diameter & 100m length kept at 30^0C. (ρ = 1000kg/m^3, μ = 5.0 kg/m.hr, Cp = 0.14 kJ/kg.K, K = 31.0 kJ/hr.m.K) **[05]**

OR

(b) The two types of material containing composite wall having 1m^2 area. The distance between walls is 0.114m, 0.229m, respectively. Temperatures are 760^0C and 76.6^0C. Thermal conductivity K_1=0.138W/m^{0}C, K_2 = 1.38 W/m^{0}C. Find the interface temperature. **[05]**

Q.4 (a) Write the construction and working of Shell & Tube heat exchanger with neat sketch. **[05]**

(b) Calculate the area of double pipe heat exchanger which has to cool 55,000 kg/hr of alcohol from 66^0C to 40^0C using 40,000kg/hr of water entering at 5^0C. (U=2888kJ/hr.m^2.k, Cp alcohol = 3.76 kJ/kg.K,Cp water = 4.18 kJ/kg.K) **[05]**

*For **counter flow** DPHE*

OR

(b) *For **parallel flow** DPHE* **[05]**

Q.5 (a) Calculate the weight ratio of solvent to feed if 100Kg of a mixture of acetone (28%) & chloroform (72%) by weight is to be separated by extraction using a solvent. The composition of extract & raffinate is as follows: **[05]**

Component (%)	Extract	Raffinate
Acetone	07.50	20.30
Chloroform	03.50	67.30

(b) Calculate the pressure required for small oxygen cylinder having 0.015m^3volume and each containing 0.5kg of O_2. Cylinder is subjected to a maximum temperature of 323K. (R = 8.314 m^3.kPa/kmole.K) **[05]**

OR

(b) Soybean seeds are extracted with hexane in an extractor. The seeds contain 18.60% oil, 69.60% solid & 12.40% moisture. The product cake contains 0.80% oil, 87.70% solids & 11.50% of moisture. Find the % loss of oil. **[05]**

Q. 6 (a) Ethylene oxide is produced by oxidation of ethylene. 100kmole ethylene is fed to a reactor and the product stream contains 80kmole ethylene oxide and 10kmole CO_2. Calculate the % Yield of ethylene oxide. **[05]**

$$C_2H_4 + 0.5O_2 \rightarrow C_2H_4O$$
$$C_2H_4 + 3O_2 \rightarrow 2CO_2 + 2H_2O$$

(b) A dilute acid containing 25% H_2SO_4 is concentrated by mixing it with a commercial grade H_2SO_4 containing 98% H_2SO_4 to get a desired concentration of 65% H_2SO_4. Calculate the quantity of dilute acid & commercial acid to be fed to produce 1000kg of the desired acid. **[05]**

OR

(b) Sulfur trioxide is produced by oxidation of sulphur dioxide. 50kmole SO_2 & 150kmole air is fed to a reactor. Calculate the % Excess Air used in oxidation reaction. $SO_2 + 0.5O_2 \rightarrow SO_3$ **[05]**

...Good Luck...

Seat No. _____ Enrollment No. _____

THE CHARUTAR VIDYA MANDAL UNIVERSITY

M.Sc Industrial Chemistry – SEMESTER II

April 2023(REGULAR) EXAMINATION

Course Title: Petrochemical Technology

Course Code: 201310205

Total Printed Pages : 01

Date: 21/04/2023 **Time: 10.00 am/pm to 12.00 noon** **Maximum Marks: 50**

Instructions:

- Attempt all questions.
- Numbers to the right indicate full marks for each question.
- Make suitable assumptions wherever necessary.

Q. 1		Answer the following multiple choice questions.	**(04)**
	(I)	An important property of natural gas is _____ A.Heating value B.Bulk density C.Pour point D. Cloud point	
	(II)	_____ is used for producing lower olefins A.Coking B.Vis breaking C.Propane Deasphalting D. Steam cracking	
	(III)	_____ is known as crown prince of petrochemicals A.Ethylene B.Propylene C.Benzene D.Toluene	
	(IV)	_____ is used to produce polyurethane A.DMSO B.TDI C.THF D.BTX	
Q.2		Answer in brief and to the Point (3 questions of 2 marks each)	**(06)**
	(I)	Define crude oil and give its composition	
	(II)	What is vis breaking?	
	(III)	Enlist the chemicals produced from direct reaction of methane	
Q.3	(a)	Give classification of crude oil and write a note on BMCI and Watson characterization factor for crude oil	**(05)**
	(b)	What is natural gas? Write a note on NGLs and its various fractions	**(05)**
		OR	
	(b)	Write a short note on Exploration techniques for crude oil	**(05)**
Q.4	(a)	Discuss in detail the technology of Coking process	**(05)**
	(b)	Explain in brief about catalytic reforming process	**(05)**
		OR	
	(b)	Explain in brief about steam cracking of hydrocarbons	**(05)**
Q.5	(a)	Discuss the technology of Synthesis gas production	**(05)**
	(b)	Give a brief account of chemicals produced by oxidation of ethylene	**(05)**
		OR	
	(b)	Discuss the production technology of Urea and Nitric acid in brief	**(05)**
Q.6	(a)	Discuss the production of Styrene from benzene	**(05)**
	(b)	Explain the technology of chlorination of benzene and nitration of benzene	**(05)**
		OR	
	(b)	Give details of various additives blended with the base oil for lubricants	**(05)**

Good Luck

Seat No. _____ Enrolment No. _____

The Charutar Vidyamandal University

M.Sc. (Industrial Chemistry), Semester- 2
April - 2023
Subject: 201310208—Air Pollution Control Technology
Tuesday, 25th April – 2023

Time: 10:00 A.M. to 12:00 Noon **Total Marks: 50**

Note: i) Attempt all the questions.
ii) Figures to right indicate full marks.
iii) Draw neat diagrams wherever it requires.

Q-1 **Answer the following Multiple Choice Questions.** **Marks (04)**

1. _____ is the major atmospheric pollutant in urban areas.
   a) Carbon Monoxides
   b) Carbon Sulphate
   c) Sulfur Oxide
   d) Nitrogen Oxide
2. In _____ inversion cloud layer absorbs incoming solar energy with a slow net downward flow.
   a) Radiation
   b) turbulence
   c) Subsidence
   d) both A & B
3. What kind of product was manufactured by the Union Carbide plant in Bhopal, India?
   a) Paints
   b) Pesticide
   c) Poison gas
   d) Plastics
4. What is the mode?
   a) Value of middle observation
   b) Most commonly occurring value
   c) Arithmetic average
   d) Difference between the highest and lowest value

Q-2 **Answer the following short questions. Each question carries equal marks** **(06)**

1. What is aeroallergen?
2. Define the secondary meteorological parameter 'precipitation'
3. What is sulfurous smog?

Q-3 (a) What are the effects of air pollution on farm animals? **(05)**

Q-3 (b) Write a note on the environmental effect on building materials. **(05)**

OR

Q-3 (b) Write a note on asbestos as an air pollutant. **(05)**

Q-4 (a) Discuss atmospheric stability and temperature inversions. **(05)**

Q-4 (b) Write a note on plume behaviour. **(05)**

OR

Q-4 (b) Discuss in brief the sampling and analytical technique for SPM pollutants. **(05)**

Q-5 (a) Briefly explain the causes and effects of the 'London smog disaster'. **(05)**

Q-5 (b) Explain the theory of the formation of photochemical smog. **(05)**

OR

Q-5 (b) Discuss natural and artificial Carbon Sequestration. **(05)**

Q-6 (a) Discuss with suitable examples the general rules like several ways, permutations, and combinations of probability to know the number of different possibilities of certain events. **(05)**

Q-6 (b) Explain with a suitable example regression analysis. **(05)**

OR

Q-6 (b) Find the standard deviation of the fpllowing data: **(05)**

The concentration of CO_2 (ppm)	105-115	115-125	125-135	135-145	145-155
No of time in a year	20	50	100	65	40

All the Best!

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