Seat No. _____   Enrolment No. _____

THE CHARUTAR VIDYA MANDAL UNIVERSITY
M.Sc. (Industrial Chemistry) Semester - 4
April 2023 Examination

Course Title: Introduction to Reaction Engineering and Steam Generation
Course Code: 101310402
Total Printed Pages : 02
Date: 18/04/2023   Time: 10.00 am to 12.00 noon   Maximum Marks: 60

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

Q-1   Answer the following multiple choice question.   [04]

1. What should be the value of m in the temperature dependency equation of k
   (i.e. $k \propto T^{(m)} . e^{-(\frac{E}{RT})}$) for Transition theory?
   a. 0   b. 0.3333   c. 0.5000   d. 1.0

2. What is the unit of rate constant (k) for a first order reaction?
   a. $1/Time^{-1}$ b. $(1/Time)^{-1}$ c. Concentration/ time   d. $Time^{-1}$

3. Unit of space velocity is_____.
   a. hr^{-1} b. hr/m   c. m/hr   d. hr

4. Which of the following is used to measure dryness fraction?
   a. Calorimeter   b. Dryer   c. Thermometer   d. Pyrometer

Q-2   Answer the following questions to the point.   [08]

1. What is an elementary reaction? Give example.
2. Enlist the methods used to determine kinetic data of the chemical reaction.
3. What is fractional volume of change?
4. What is thermal efficiency in boiler?

Q-3   (a) Determine the minimum amount of energy of reaction using Arrhenius & Collision   [06]
            theories. The rate of reaction at 627^0C is 10 times the rate at 427^0C. R = 1.98 cal./gm.K.

(b) Discuss & derive the integral method analysis straight line equation for the reaction   [06]
       $A + B \rightarrow P$.

OR

(b) Calculate the first order rate constant of the reaction using following data.   [06]
       C_{A0} = 0.22 mole/liter.

C_A (mole. liter^{-1})	0.12	0.07	0.05	0.032	0.032
Time (min.)	100	200	300	400	500

Q-4 **(a)** Write a note on Plug flow reactor (PFR) with its industrial application. **[06]**

(b) Sample is studied with N_2 adsorb at 195^0C if the vapour pressure of N_2 is 760mm of Hg. **[06]** Calculate the surface area of sample using BET method. (V= 22400 cm^3/gm.mole, N_0 = 6.023×10^{23} mole, Density of N_2 is 0.808 gm/cm^3)

P (mm of Hg)	100	200	400	600	700
υ (cm^3)	61	127	170	197	215

OR

(b) Reaction $2A \rightarrow 4B$ is carried out with initial concentration of 0.0625 mole/liter has a **[06]** rate equation $-r_A = 0.01C_A^{0.5}$ in CSTR system. Calculate the space time (minute) required for 85% conversion of A.

Q-5 **(a)** Derive the reaction time equation for 1st & 2nd order variable volume reaction. **[06]**

(b) Determine the reaction minutes taken for concentration to drop from 1.30mole/liter to **[06]** 0.3mole/liter for reaction $A \rightarrow B$ in batch reactor.

| C_A	0.1	0.2	0.4	0.5	0.6	0.8	1.0	1.3	2.0
$-r_A$	0.1	0.3	0.6	0.5	0.25	0.06	0.05	0.045	0.045

OR

(b) Reaction $A \rightarrow 2B$ is to taken place in batch reactor with rate constant $0.15min^{-1}$. **[06]** Determine the time required for 70% conversion where initial concentration is 0.30mole/liter.

Q-6 **(a)** Calculate the enthalpy & volume of superheated steam of 1kg steam at 8.0 bar absolute **[06]** pressure for following condition if Cps = 2.1kJ/kg.K:

1. Steam is 10% wet
2. Steam is superheated to 280^0C
3. Volume of superheated steam

P (bar)	Ts (^0C)	Sp. Enthalpy (kJ/kg)			Sp. Volume	
		hf	hfg	hg	Vf	Vg
8.0	170.4	720.9	2046.5	2767.5	0.001115	0.240

(b) A gas mixture supplied to a boiler of 75% efficiency contains the following component. **[06]** The latent heat is equal to 2442.5kJ/kg. GCV of CH_4, H_2, CO_2 is 890.65, 285.83, 282.98 kJ/mole respectively. Calculate the net calorific value for following reaction if CH_4 is 95%, H_2 is 2% and CO_2 is 3% in composition.

$$H_2 + 0.5O_2 \rightarrow H_2O$$
$$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$$
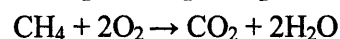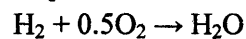
OR

(b) A fuel mixture contains 80% methane and 20% ethane. Calculate it's gross calorific **[06]** value. Latent heat = 2442.5 kJ/kg.

$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$ (NCV= 802.600 kJ/mole)

$C_2H_6 + 3.5O_2 \rightarrow 2CO_2 + 3H_2O$ (NCV=1428.64 kJ/mole)

...Good Luck...

THE CHARUTAR VIDYA MANDAL UNIVERSITY

M.Sc Industrial Chemistry – SEMESTER IV

April 2023 (REGULAR) EXAMINATION

Course Title: Process Development In Chemical Industries

Course Code: 101310403

Total Printed Pages : 02

Date: 20/04/2023   Time: 10.00 am to 12.00 noon   Maximum Marks: 60

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)

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

(I)   _____ is a desirable goal in view of the high proportion of unskilled labour in batch processing.
   A. Cost Effectiveness   B. Safety
   C. Operational simplicity   D. Resource Efficiency

(II)   _____ refers to naturally occurring and relatively abundant optically active substances
   A. Chiral Pool   B. Biotechnology
   C. Racemate Resolution   D. Asymmetric synthesis

(III)   _____ is a technique of covering and protecting a reagent by a polymer
   A. Impregnation B. Microencapsulation C. Adsorption D. Grinding

(IV)   A chemical is considered _____ if a small quantity can cause injurious effect to an average human.
   A. Flammable B. Reactive C. Toxic D. None of these

Q.2   Answer in brief and to the Point   (08)
(I)   Define the term space time yield
(II)   Define the term reagent
(III)   What is CHETAH?
(IV)   What is E factor?

Q.3   (a)   Discuss the following goals of process development: (06)
       i. Cost effectiveness and yield ii. Resource efficiency iii. Environmental friendly process iv. Operational simplicity

(b)   Write a detailed note on investigative approach to process development   (06)
                                    OR
(b)   Discuss scope and limitation of process development   (06)

Q.4   (a)   Define the term catalyst and discuss the various causes of deactivation of   (06)
              catalyst viz. Deposits, Poisoning, Aging and sintering, Loss via gas phase

(b)   Write a note on evaporators and condensors   (06)
                                    OR
(b)   Write a note on waste disposal system   (06)

Q.5   (a)   What is chiral technology? Explain the terms Racemate, Achiral,   (06)
              Homochiral and Enantiomeric excess with respect to chiral technology

P.T.O.

	(b)	Which are the various ways of modification of reagents? Write a brief note on supported reagents	(06)

OR

	(b)	Write a detailed note on various points of differentiation on telescoping and one pot synthesis	(06)

Q.6	(a)	Define the term work up and discuss classical and aqueous work up.	(06)
	(b)	Write a note on chemical and physical purity	(06)

OR

	(b)	Discuss advantages of early detection of chemical reaction hazard	(06)

Best of Luck

THE CHARUTAR VIDYA MANDAL UNIVERSITY
M.Sc.(Industrial Chemistry) – SEMESTER 4
SUMMER 2023 (REGULAR) EXAMINATION

Course Title: Technology of Chemical Process Industries

Course Code: 101310404

Total Printed Pages : 02

Date: 24/04/2023   Time: 10.00 am to 12.00 pm   **Maximum Marks: 60**

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) _____ the difference in refractive index the more opaque the film.
a.	Lesser	b.	Similar
c.	Greater	d.	None

(ii) Unsaturation of vegetable oils can be determined by knowing
a.	Acid value	b.	Iodine value
c.	Saponification value	d.	Hydroxyl value

(iii) Blocked isocyanates can be 'unblock' in the presence of:
a.	Amines	b.	Amides
c.	Anhydrides	d.	Esters

(iv) The chemical preparations whose vapours are poisonous, can be termed as:
a.	Fumigants	b.	Orodispersible
c.	Rodenticide	d.	Can't say

Q.2   Answer in brief and to the Point (**2 marks each**)   **(08)**

(i) Give the difference between pigment and dyes.

(ii) What is the oleoresinous media?

(iii) Define Type 1: one-package pre-reacted polyurethanes.

(iv) Explain the natural insecticides.

Q.3 (a) Give the classification of dyes. Write the manufacturing process of TiO_2 by using chloride process with schematic diagram.   **(06)**

(b) Write a note on Iron oxide.   **(06)**

OR

(b) What is a Vat pigment? Describe Anthraquinone based pigments.   **(06)**

Q.4 (a) Write the finished products based on oleoresinous media and also write the finished Product testing.   **(06)**

(b) What is amino resin? Write the formation of amino resins. **(06)**

OR

(b) Elaborate the Extraction of oil by **(06)**
   a. Mechanical extraction
   b. Solvent Extraction

Q.5 (a) Define solvent and also elaborate classification of solvents. **(06)**

(b) Describe the curing systems used with epoxide resins. **(06)**

OR

(b) Write a note on additives in coating material **(06)**

Q.6 (a) Write the manufacturing process and uses of DDT. **(06)**

(b) Write the preparation and uses of Urea with flow-diagram. **(06)**

OR

(b) Write a note on the production of superphosphate fertilizers. **(06)**

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Seat No. _____   Enrolment No. _____

The Charutar Vidyamandal University
M.Sc. (Industrial Chemistry), Semester- 4
April - 2023
Subject: 101310406—Advanced Analytical Chemistry
Wensday, 26th April – 2023

Time: 10:00 A.M. to 12:00 Noon   **Total Marks: 60**

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

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

1. Raman effect is a scattering of _____.

   a) Atoms   c) Protons

   b) Molecules   d) Photons

2. ICP's principle is similar to which of the following?

   a) Flame emission spectroscopy   c) Atomic emission spectroscopy

   b) Fourier transforms spectroscopy   d) Absorption spectroscopy

3. The secondary electrons radiated back in the scanning microscope are collected by_____.

   a) specimen   c) vacuum chamber

   b) anode   d) cathode

4. Dry dispersion is not suitable for _____ particles.

   a) Fine powders   c) Only for big powders

   b) Very fine powders   d) None of above

Q-2   Answer the following short questions. Each question carries equal marks   (08)
1. What is the principle of Raman spectroscopy?
2. Draw a schematic diagram of the ICP torch.
3. What is TEM?
4. Define Hydrodynamic diameter.

Q-3   (a)   What is the mutual exclusion principle of Raman? Explain with its example.   (06)

Q-3   (b)   1) What is the scattering geometry of Raman?   (03)
              2) Difference b/w Raman & IR.   (03)

                                    OR

Q-3   (b)   Discuss Rayleigh scattering, Stocks & Anti- stocks scattering concerning the energy   (06)
              associated with these.

Q-4	**(a)**	Discuss in detail the generation of ICP.	**(06)**
Q-4	**(b)**	Explain with neat figures/diagrams various nebulizers used in ICP.	**(06)**

OR

Q-4	**(b)**	Discuss with diagram axial and radial view of ICP.	**(06)**

Q-5	**(a)**	Discuss the effects of electron interaction with the sample in TEM.	**(06)**
Q-5	**(b)**	Differentiate between SEM & TEM.	**(06)**

OR

Q-5	**(b)**	What is electrolytic polishing in TEM? Explain with figure TEM sample holders.	**(06)**

Q-6	**(a)**	Discuss wet & dry dispersion techniques in PSA.	**(06)**
Q-6	**(b)**	Write a note on the equivalent sphere concept.	**(06)**

OR

Q-6	**(b)**	What is Rheological property? Write a note on Zeta potential.	**(06)**