Seat No. _____ Enrollment No. _____

THE CHARUTAR VIDYA MANDAL UNIVERSITY

M.Sc. INDUSTRIAL CHEMISTRY

Semester 4 Examination

1013104 02 : Introduction to Reaction Engineering and Steam Generation

Monday, 11th April - 2022

Time: 1:30 pm to 3:30 pm **Total Marks: 60**

Instructions:

Attempt all questions.

Numbers to the right indicate full marks for each question.

Q-1 Answer the following multiple choice question. **[12]**

1. What is the unit of rate constant (k) for a zero order reaction?
   a. Concentration/ time b. Mole/ (volume . time)
   c. Volume/(mole.time) d. $Time^{-1}$
2. What is the fractional volume of change (ε_A) for the reaction $A \rightarrow 1.6R$.
   a. 0.60 b. 1.60 c. - 0.60 d. -0.60
3. Which of the following reactor does consist with no diffusion along the flow path?
   a. PFR b. CSTR c. Continuous reactor d. Batch reactor
4. Which of the following reactor is equipped with an impeller or other mixing device to provide efficient mixing?
   a. Non ideal b. CSTR c. PFR d. Trickle bed
5. No. of reactor volumes of feed can be treated in unit time is known as_____.
   a. Space time b. Processing time
   c. Space velocity d. Residence time
6. Unit of space time is_____.
   a. $Second^{-1}$ b. Second/m c. m/second d. Second
7. Which method is used to find out rate constant and order of reaction in reaction engineering?
   a. BET b. Differential c. Homogeneous d. Integral
8. Which of the following factor does not consider for reactor design in reaction engineering?
   a. Economy b. Chemical kinetics c. Employee training d. Heat transfer
9. The difference between the superheated temperature and the saturation temperature is known as_____.
   a. Heat of superheat b. Degree of superheat
   c. Enthalpy of superheat d. Heat difference
10. What is the unit of specific volume of steam?
    a. cm^3/kg b. kg/cm^2 c. cm^2/kg d. kg/cm
11. Dryness fraction can be measured using_____.
    a. Drier b. Pyrometer c. Thermometer d. Calorimeter
12. Identify the correct equation from following.
    a. GCV = NCV b. $m\lambda$ = GCV- NCV
    c. NCV =GCV + $m\lambda$ d. NCV=GCV – λ

Q-2 **Answer any eight of following.** **[16]**

1. Write any two homogeneous reactions.
2. What is rate of reaction? Give its unit.
3. Define non-elementary reactions with example.
4. What is second order of reaction?
5. What is collision state theory?
6. Compare constant and variable volume reaction.
7. Why BET method is used in material science?
8. Define enthalpy and entropy.
9. What is boiler efficiency?
10. Define dryness fraction of steam.

Q-3 Discuss & derive the integral method analysis straight line equation for the reaction $2A \rightarrow B$. **(08)**

OR

Q-3 The rate of reaction at 900K is 10 times the rate at 700K. Calculate the activation energy for three laws of reaction using R = 1.98 cal/gm.K. **(08)**

Q-4 Glucose sample is studied with N_2 adsorb at 195°C if the vapour pressure of N_2 is 760Hg. Calculate the surface area of glucose. (V= 33400 cm^3/gm.mole, N_0 = 6.022 x 10^{23} mole, Density of N_2 is 0.808 gm/cm^3) **(08)**

P	6	25	140	228	285	320	430	505
υ (cm^3)	61	127	170	197	215	230	277	335

OR

Q-4 Reaction $P \rightarrow 2R$ is to take place in a batch reactor with rate constant 0.15$minute^{-1}$ where initial concentration of P is 0.30mole/liter. Determine the minutes required for 75% conversion of P. **(08)**

Q-5 Derive the equation of constant volume batch reactor for following: **(08)**

a. First order reaction b. Second order reaction.

OR

Q-5 Calculate the porosity and average pore radius of 50gm catalyst sample with the surface area 0.2 x 10^7 cm^2/gm. **(08)**

He displaced = 45.12 cm^3

Hg displaced = 82.70 cm^3

Q-6 Calculate the enthalpy of 1kg steam at 12.0 bar absolute pressure for following condition if Cps = 2.1kJ/kg.K: **(08)**

1. Steam is dry.
2. Dryness fraction of steam is 0.78
3. Steam is superheated to 250°C.

P (bar)	Ts (°C)	Sp. Enthalpy (KJ/Kg)		Sp. Volume	
		hf	hfg	Vf	Vg
12	188.0	798.4	1984.3	0.001139	0.163

OR

Q-6 GCV of H_2, CH_4, C_2H_6, C_3H_8, C_4H_{10} and C_5H_{12} is 285.83, 890.65, 1560.69, 2219.17, 2877.40 and 3535.77 kJ/mole respectively. The latent heat is equal to 2442.5 KJ/kg. If H_2 is 74%, CH_4 13.5%, C_2H_6 is 7.40%, C_3H_8 is 3.60%, C_4H_{10} is 1.20% and C_5H_{12} is 0.30%. Calculate the NCV for following data: **(08)**

$$H_2 + 0.5O_2 \rightarrow H_2O$$
$$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$$
$$C_2H_6 + 3.5O_2 \rightarrow 2CO_2 + 3H_2O$$
$$C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$$
$$C_4H_{10} + 6.5O_2 \rightarrow 4CO_2 + 5H_2O$$
$$C_5H_{12} + 8O_2 \rightarrow 5CO_2 + 6H_2O$$

---------Good Luck---------

Seat No. _____ Enrollment No. _____

THE CHARUTAR VIDYA MANDAL UNIVERSITY

M.Sc. (Industrial Chemistry)

Semester-IV Examination-APRIL '2022

Tuesday, 12/04/2022

101310403: Process Development in Chemical Industries

01:30 PM to 03:30 PM **Total Marks: 60**

Note: (1) Attempt all questions.
(2) Figures to the right indicate Full marks.

Q. 1 Answer the following multiple choice questions. (12)

(1) Process Research aims at optimized_____
A. Process B. Chemistry C. Research D. Product

(2) _____ is the limitation in process development.
A. Time B. hazardous chemicals
C. Very low temperature D. All of these

(3) _____ industry generates the highest amount of waste
A. Pharmaceutical B. Petroleum C. Bulk chemicals D. None of these

(4) Modern analytical methods such as GLC and HPLC can detect _____% of enantiopurity.
A. 1 B. 0.1%
C. 10% D. 0.01%

(5) A reactor is a _____ of every chemical plant.
A. Heart B. Soul C. Mind D.Heart & Soul

(6) Besides pumps, _____are, in terms of numbers, the most common apparatus in chemical plants
A. Distillation columns B. Heat exchangers
C. Condensors D. Filters

(7) _____ of the catalyst largely determines the size of the reactor.
A. Reactivity B. Selectivity C. Activity D. All of these

(8) _____ is the most widely used energy carrier for heating columns
A. Hot air B. Downtherm C. Electrotherm D. Steam

(9) The reaction components are generated in situ due to problems of _____
A. Cost B. Availibility C. Toxicity D. Chirality

(10) _____ are the foul smelling compounds generated in no. of reactions using DMSO
A. Sulphides B. Sulphates C. Phosphates D. Carbonates

(11) Solvents dissolves solutes by the process of _____.
A. Dispersion B. Solvation C.Wetting D. Emulsions

(12) The main aim of the work-up is to _____ most of the product obtained in the reaction.
A. Purify B. Dry C. Isolate D. Crystallize

Q.2 Attempt **any eight** of the following short questions. (16)

(1) Differentiate between process research and process development
(2) Explain the terms process simplicity and robustness of the process
(3) What is atom economy?
(4) Define the terms E-factor and Achiral
(5) What is Chiral Pool?
(6) Define the term Reagent.

(7) What is Polarity according to Reichardt?
(8) Define the term activity and selectivity of catalyst
(9) Define the terms LC50 and LD50
(10) Define UFL and LFL

Q. 3 Discuss various desirable goals of process development in detail. **(08)**

OR

Q.3 What is exploratory or investigative approach in process development? Discuss various reaction variables which are investigated during process development. **(08)**

Q. 4 Present a detailed account of catalyst with special emphasis on catalyst performance and catalyst life. **(08)**

OR

Q. 4 Write a note on stirred tank reactor, tubular reactor, fluidized bed reactor and micro-reactors in brief. **(08)**

Q. 5 Discuss the following technologies in brief: **(08)**
i. Telescoping and One Pot synthesis ii. Like dissolves like and its exceptions in solvents.

OR

Q. 5 What is chiral technology? Discuss various factors responsible for rapid growth of chiral technology. **(08)**

Q. 6 I What is reaction work-up? Discuss classical work-up and its disadvantages. **(08)**
ii What is purity? Write a brief note on chemical purity.

OR

Q. 6 Write a note on flammable chemicals, toxic chemicals and explosive chemicals with respect to process safety management. **(08)**

Best of Luck

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Seat No. _____ Enrollment No. _____

THE CHARUTAR VIDYA MANDAL UNIVERSITY

M.Sc. Industrial Chemistry – SEMESTER 4

SUMMER 2022 EXAMINATION

Course Title: Technology of Chemical Process Industries

Course Code: 101310404

Total Printed Pages : 02

Date: 13/04/2022 **Time: 01.30 pm to 03.30 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. **(12)**

(1) Greater the difference in refractive index of the pigment the formed film will be more:

a. Clear **b.** Transparent
c. Smooth **d.** Opaque

(2) Particles that are firmly 'cemented' together at crystalline areas.

a. Secondary particles **b.** Agglomerates
c. Primary particles **d.** Aggregates

(3) Lakes, are cheap pigment and

a. Very poor solvent fastness **b.** Tinctorially weak
c. Good resistance to light **d.** Good resistance to chemicals

(4) Drying oils have iodine values:

a. Between 120 and 150. **b.** Between 80 and 120.
c. Above 150. **d.** Below 50

(5) Alkyd used to describe the polyesters resulting from the reaction of polyhydric alcohols and:

a. Poly functional acids. **b.** Esters
c. Acetic anhydride **d.** Mono functional acid

(6) Methylol is produce by the reaction between amino containing materials such as urea and melamine and :

a. Aldehyde **b.** Amide
c. Ester **d.** Ether

(7) Blocked isocyanates can be 'unblock' in the presence of:

a. Amines **b.** Amides
c. Anhydrides **d.** Esters

(8) Water is readily available, comparatively inexpensive and environmentally:

a. Toxic solvent **b.** Hazardous solvent
c. Clean solvent **d.** None

(9) Forming a solution is simply a process of:

a. Aggregating molecule **b.** Separating molecules
c. Making lumps **d.** None

(10) A deficiency of sulfur decreases the plant growth accompanied by extensive

affecting the green parts by:

a. Reddening
b. Blackening
c. Yellowing.
d. None

(11) It is obtained as a poisonous principal from the roots of derris plants and other tropical and subtropical plants:

a. Nicotine
b. Opium
c. Neem
d. Rotenone

(12) 2, 2, dimethyl-3-isopropylidenecyclopropyl propionate and it is used for cockroaches successfully is:

a. Herbicide
b. Sex-attractants
c. Rodenticide
d. Pesticide

Q.2 Attempt **any eight** of the following. **(16)**

(1) Difference between organic and inorganic pigments
(2) Describe Azo-pigment.
(3) Define the role of Asbestos as extender.
(4) Define Oleoresinous media
(5) Write the structure of fixed oil.
(6) Describe the continuous basket extractor with schematic diagram.
(7) Give the classification of solvent.
(8) Enlist the Curing systems used with epoxide resins.
(9) What is fumigant? Give its examples.
(10) Describe leaching process in preparation of potassium chloride.

Q. 3 Give the classification of dyes. Write the manufacturing process of TiO_2 by using sulphate process with schematic diagram. **(08)**

OR

Q.3 Write a note on extender pigment. **(08)**

Q. 4 Describe alkyd resin and give manufacturing process of alkyd resin by using fatty acid process with its uses. **(08)**

OR

Q. 4 Write a note on polyester. **(08)**

Q. 5 What is polyurethane? Give the classification of polyurethanes. **(08)**

OR

Q. 5 Write a note on additives in coating material. **(08)**

Q. 6 Write the classification of fertilizer. **(08)**

OR

Q. 6 Write a note on insecticide. **(08)**

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Seat No. _____ Enrolment No. _____

The Charutar Vidyamandal University

M.Sc. (Industrial Chemistry), Semester- 4
April - 2022
Subject: 101310406—Advanced Analytical Chemistry
Thursday, 14th April – 2022

Time: 01:30 P.M. to 03:30 P.M. **Total Marks: 60**

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 (12)**

1. Raman effect is scattering of _____.
   a) Atoms
   b) Protons
   c) Molecules
   d) Photons
2. The elastic scattering of photons is called _____.
   a) Atmospheric scattering
   b) Conserved Scattering
   c) Rayleigh Scattering
   d) Raman Scattering
3. Which of the following cannot be conserved during Raman scattering?
   a) Atmospheric scattering
   b) Conserved Scattering
   c) Rayleigh Scattering
   d) Raman Scattering
4. For a spherical particle of diameter D_p, Φ_s is ____
   a) 0
   b) 0.5
   c) 1
   d) 2
5. Dry dispersion is not suitable for ____ particles.
   a) Fine powders
   b) Very fine powders
   c) Only for big powders
   d) None of above
6. For coarse grained soil, the particle size D10 is sometimes called as _____
   a) Effective size and effective diameter
   b) Uniform diameter
   c) All of the mentioned
   d) None of the mentioned
7. Liquid samples are introduced into the ICP spectrometer using which of the following?
   a) Nebulizer
   b) Corvette having glass windows
   c) Probe
   d) Laser ablation system
8. Atomization or ionization occurs at which of the following conditions?
   a) Vacuum pressure
   b) Atmospheric pressure
   c) Low pressure
   d) High pressure
9. The most common type of ion detector found in ICP system is which of the following?
   a) Faraday cup collector
   b) Channeltron
   c) Micro-channel plate
   d) Flame ionization detector
10. _____ electron - an electron emitted by a photocathode or dynode in a photomultiplier tube.
    a) Secondary
    b) Primary
    c) Combine
    d) None of these

11. Which of the following is used in an electron microscope?

a) electron beams
b) magnetic fields
c) light waves
d) electron beams and magnetic fields

12. The secondary electrons radiated back in scanning microscope is collected by___.

a) specimen
b) anode
c) vacuum chamber
d) cathode

Q-2 Answer the following short questions. (**Any Eight**) **(16)**

1. Draw a schematic diagram of Raman spectrometer..
2. Write four differences between Raman & IR.
3. Define Hydrodynamic diameter.
4. What is a rheological property?
5. What are the major uses of ICP-OES technique?
6. Draw a schematic diagram of ICP torch.
7. What is electrothermal vaporization?
8. What is TEM?
9. What is electrolytic polishing in TEM?
10. Draw a figure of TEM sample holders.

Q-3 What is Raman spectroscopy? Explain Rayleigh scattering, Raman scattering & IR absorption using diagram. **(08)**

OR

Q-3 Write a note on sampling preparation methods for Raman spectroscopy. **(08)**

Q-4 Write a note on Laser diffraction technique of the PSA. **(08)**

OR

Q-4 Explain with example distribution technique in PSA. **(08)**

Q-5 Explain with neat figure/diagram various nebulizers used in ICP. **(08)**

OR

Q-5 Discuss the generation of ICP and write applications of its. **(08)**

Q-6 Discuss effects of electron interaction with the sample in TEM. **(08)**

OR

Q-6 Differentiate between SEM & TEM. **(08)**

All the Best!

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