[112] SEAT No._____ No. of Printed Pages : 02 Sc

SARDAR PATEL UNIVERSITY
EXTERNAL EXAMINATION
M.SC. INDUSTRIAL CHEMISTRY
(FOURTH SEMESTER)
PS04CICH22: INTRODUCTION TO REACTION ENGINEERING AND STEAM GENERATION
MONDAY, 18TH MARCH, 2019

Time: 2:00 pm to 5:00 pm **Total Marks: 70**

Q-1. Answer the following multiple choice question. **[08]**

1. What is the unit of rate constant for first order reaction?
   a. Second^{-1} b. Second
   c. Volume/Mole d. Concentration
2. In which of the following order reaction, What is the unit of rate constant for first order reaction?
   a. Zero b. Second c. First d. Third
3. What should be the fractional volume change for the reaction $2A \rightarrow 3B + 3C$ with pure A compound.
   a. -0.66 b. 2.0 c. -2.0 d. 0.66
4. Which of the following reactor has same exit stream concentration as the fluid within the reactor?
   a. PFR b. CSTR c. Slurry d. Trickle bed
5. What should be the dryness fraction of dry steam?
   a. =1 b. 0.1 c. <1 d. >1
6. During adding latent heat, there is change in_____.
   a. Phase b. Temperature & Phase
   c. Temperature d. None of these
7. A mounting which controls the supply of water to boiler is_____.
   a. Feed check valve b. Feed water heater
   c. Blow off cock d. Safety valve
8. Which of the following is used to add fuel into the furnace?
   a. Fire hole b. Super heater c. Man hole d. Economizer

Q-2 Answer any seven of following. **[14]**

1. What is temperature dependency of rate of reaction?
2. Enlist the variable which affects the rate of homogeneous reaction.
3. Write the equation of 1st order variable volume batch reactor.
4. Define space velocity with example.
5. What is Exist age distribution?
6. Enlist the steps involved for the catalyst in the reaction.
7. Define superheated steam and wet steam.
8. Define the term net calorific value with its unit.
9. Define latent heat with it's value.

(P.T.O)

Q-3 **a.** Derive the equation for first order of reaction using Integral method. **(06)**

b. Calculate the rate constant and order of reaction using following data. **(06)**

C_A	0.18	0.14	0.12	0.10	0.08	0.08
Time (min.)	0	36	65	100	160	180

OR

b. The rate of reaction at 550K is 10 times the rate at 450K. Find out the activation energy (Collision & Transition theories) of reaction using R = 1.98 cal/gm.K. **(06)**

Q-4 **a.** Derive the equation for variable volume batch reactor for first and second order reactions. **(06)**

b. Calculate the reaction minutes required for the concentration to drop form 1.35mole/liter to 0.35mole/liter for the reaction A → R for following data. **(06)**

C_A	0.15	0.20	0.45	0.50	0.65	0.80	1.00	1.35	2.00
$-r_A$	0.10	0.30	0.50	0.50	0.25	0.06	0.05	0.045	0.045

OR

b. Write a note on continuous stirred tank reactor in detail. **(06)**

Q-5 **a.** With neat diagram discuss the slurry reactor in detail. **(06)**

b. In CSTR time interval are recorded at various concentration of tracer as per following data. Determine the residence time distribution. **(06)**

Time (min.)	0	5	10	15	20	25	30	35
Conc.	60	70	79	88	84	2	1	0

OR

b. A first order reaction A → R + S taken place with rate constant of $10hr^{-1}$. Calculate the time required for 80% conversion. **(06)**

Q-6 **a.** A fuel mixture contains 80% methane and 20% ethane. **(06)**
Calculate it's gross calorific 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)

b. Discuss the factors which affect the selection of boiler. **(06)**

OR

b. A vessel of volume $0.05m^3$ contains dry steam at 18 bar. Determine the mass and enthalpy of steam. **(06)**

P (bar)	Ts (^{0}C)	Sp. Enthalpy (KJ/Kg)			Sp. Volume (m^3/kg)	
		hf	hfg	hg	Vf	Vg
18	207.1	884.6	1910.3	2794.8	0.001168	0.110

—X—