Enrollment No. _____

Shree Manibhai Virani and Smt. Navalben Virani Science College (Autonomous)
Affiliated to Saurashtra University, Rajkot

SEMESTER END EXAMINATION APRIL – 2017

M. Sc. Industrial Chemistry

16PICCC06 – CHEMICAL REACTION ENGINEERING

Duration of Exam – 3 hrs ***Semester – II*** ***Max. Marks – 70***

***Part A** (5x2= 10 marks)*

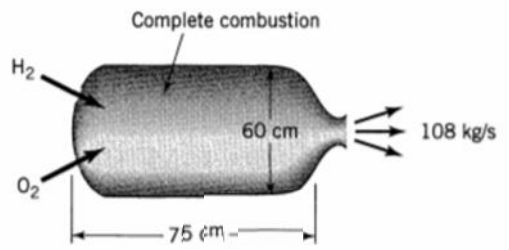
Answer **ALL** questions

1. What is meant by the term Chemical Reaction Engineering?
2. Give reason why molecularity of any reaction cannot be more than 4.
3. Define: a) Space Velocity b) Space time
4. List various possible Stimulus Response techniques used to study the flow in vessels.
5. Give un-reacted core model for heterogeneous reaction.

***Part B** (5X5 = 25 marks)*

Answer **ALL** questions

6a. A rocket engine burns fuel stoichiometricaly a mission of fluid liquid hydrogen and liquid oxygen conversion chamber is 75cm long and 60 cm in diameter. Combustion produces 108 Kg/s of exhaust gases. If the combustion is complete, find the rate of reaction of H2 & O2 in unit volume of reactor.



Given volume of cylindrical reactor = $\frac{\pi}{4} d_2 l.$

OR

6b. Rate law for the reaction A + B +C = PRODUCTS is given as

Rate = $K[A][B][C]^2$.

How would the rate of reaction change when:

i) Concentration of C is doubled.
ii) Concentration of A is halved.
iii) Concentrations of A & C are doubled.
iv) Concentration of A, B and C are tripled.
v) Concentration of A & B are doubled and C is made one third.

7a. Derive a relationship for time required for a first order reaction to complete 40% reaction and 60% reaction.

OR

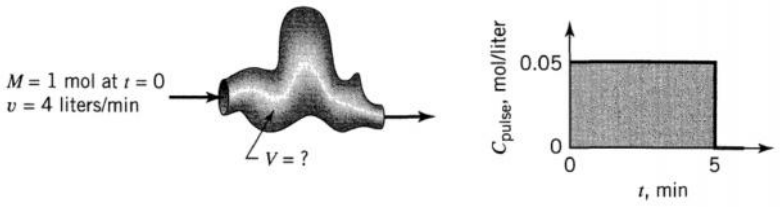
7b. Derive a relationship for time required for a first order reaction to complete 99.9% reaction and 50% reaction.

8a. Give characteristics, advantages and disadvantages of a batch Reactor.

OR

8b. Give characteristics, advantages and disadvantages of PFR.

9a A pulse input to a vessel gives the results shown in below figure:



i) Check the material balance with the tracer curve to see whether the results are consistent.

ii) If the result is consistent, determine mean residence time, volume of reactor V and sketch the E curve.

OR

9b Explain in brief tanks-in-series model for non ideal flow.

10a Write a note on mechanism of a catalyst.

OR

10b Write a note on chemical adsorption.

<u>Part C</u> (5X7 = 35 marks)

Answer **<u>ALL</u>** questions

11a. Enlist factors affecting rate of chemical reaction. Explain any three.

OR

11b. Explain in detail:

i) Average rate of reaction

ii) Instantaneous rate of reaction

12a. Derive an integrated rate law equation for first order reaction.

OR

12b. Derive an integrated rate law equation for second order reaction.

13a. Derive a design equation for CSTR.

OR

13b. Derive a design equation for PFR.

14a Derive and discuss dispersion model for non-ideal flow.

OR

14b Define E, F, & C curves and derive relation between them.

15a Explain in detail mechanism of solid catalyzed gas phase reaction (L-H-H-W model).

OR

15b Explain and derive equation for BET theory.