TE/ Sem V/ CHEM/ CBSGS/CRE-I (01)

Q.P.Code : 573802

(24)

(3 hours)

Total Marks: 80

N. B. (i) Question number **one is compulsory.**
(ii) Answer any **three** questions from the rest.
(ii) Assume suitable data wherever necessary.

Q.1.a) Define Space time and Space Velocity. (05)

b) In a homogeneous isothermal liquid polymerization, 20% of the monomer disappears in 34 min for initial monomer concentration of 0.04 and also for 0.8 mol/lit. What rate equation represents the disappearance of the monomer? (05)

c) Derive the performance equation for Plug flow reactor. (05)

d) Write short note on Optimum temperature progression (05)

Q.2.a) The reaction between nitric oxide and oxygen. (10)

$2NO + O_2 \rightarrow 2NO_2$ follows the rate law

$$\frac{-d[O_2]}{dt} = k[NO]^2[O_2]$$

Suggest a reaction mechanism which is consistent with this rate law.

b) Explain and Derive integrated form of first order Autocatalytic reaction. (10)

Q.3a) A 400 litre MFR and a 100 litre PFR are available to process 1 litre of a feed per second. The feed contains 41mol % A., 41 mole % B and 18 mole% inerts by volume. The irreversible gas phase reaction $A + B \rightarrow C$ is to be carried out at 10 atm and 227°C. the rate of reaction in mol/(l.min) as a function of conversion is as follows: (12)

X_A	0.0	0.1	0.40	0.7	0.90
$-r_A$	0.2	0.0167	0.00488	0.00286	0.00204

What is the maximum conversion that can be achieved with these two reactors connected in series?

b) An industrial unit has two mixed flow reactors of unequal size for producing a specified product according to first order kinetics. How should these reactors be connected to obtain a maximum production rate? (08)

TURN OVER

Q.4 a) Determine the activation energy and write complete rate equation for the decomposition of HI from the following data. (10)

Temperature (K)	573	673	773
Rate Constant (Sec^{-1})	2.91×10^{-6}	8.38×10^{-4}	7.65×10^{-2}

b) Find the first-order rate constant for the disappearance of A in the gas reaction $2A \rightarrow R$ if, on holding the pressure constant, the volume of the reaction mixture, starting with 80% A, decreases by 20% in 3 min. (10)

Q.5) The first order irreversible liquid phase reaction is carried out in a mixed flow reactor. The density of reaction mixture is 1.2 g/cm^3 and the specific heat is 0.9 cal/(g.^{0}k). The volumetric flow rate is 200cm^3/s and the reactor volume is 10 litres. (20)

$k = 1.8 \times 10^5 e^{-12000/RT}$, s^{-1}

If the heat of reaction is -46000 cal/mol and feed temperature is 20 ^{0}C, what are possible temperatures and pressures for stable, adiabatic operation for feed concentration of 4 mol/lit?

Q.6.a) Explain Integral and Differential method of analysis of rate data. (10)

b) Write short note on Recycle Reactor. (10)
