NATIONAL INSTITUTE OF TECHNOLOGY CALICUT

Test 2 – October 2014

B.Tech Chemical Engineering V Semester

CH3003/CHU312 CHEMICAL REACTION ENGINEERING

Any missing data maybe suitably assumed

Time: 1 hour Maxi. Mark : 20

1. The first order reversible liquid reaction (4)

$$A \longrightarrow R, \quad C_{A0} = 0.5 \text{ mol/liter}, \; C_{R0} = 0$$

takes place in a batch reactor. After 8 minutes, conversion of A is 33.3% while equilibrium conversion is 66.7%. Find the rate equation for this reaction.

2. At room temperature sucrose is hydrolyzed by the catalytic action of the enzyme sucrose as follows: (5)

$$\text{Sucrose} \xrightarrow{\text{sucrose}} \text{Products}$$

Starting with a sucrose concentration C_{A0} = 1.0 millimol/liter and an enzyme concentration C_{E0} = 0.01 millimol/liter, the following kinetic data are obtained in a batch reactor

C_A, millimol/liter	0.84	0.68	0.53	0.38	0.27	0.16	0.09	0.04	0.018	0.006	0.0025
t,hr	1	2	3	4	5	6	7	8	9	10	11

Determine whether these data can be reasonably fitted by a kinetic equation of the Michaelis – Menten type, or

$$-r_A = \frac{k_3 C_A C_{E0}}{C_A + C_M} \quad \text{Where } C_M = \text{Michaelis constant}$$

If the fit is reasonable, evaluate the constants k_3 and C_M. Solve by the integral method.

3. The following data are obtained at 0°C in a constant-volume batch reactor using pure gaseous A: (5)

Time, min	0	2	4	6	8	10	12	14	∞
Partial Pressure of A, mm	760	600	475	390	320	275	240	215	150

The stoichiometry of the decomposition is A $\longrightarrow$ [illegible] R. Find a rate equation which satisfactorily represents this decomposition. Use differential method of analysis

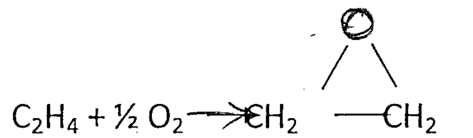
4. Set up a stoichiometry table(column1:particular species, column 2: number of moles of each species initially present, column3: the change in number of moles due to reaction,column4:the number of moles remaining in the system at time t) for each of the following reactions and express the concentration of each species in the reaction as a function of conversion .
(Evaluating all constants Є and M,) (6)

(a) The gas-phase pyrolysis

a. C_2H_6 $\quad$ $C_2H_4 + H_2$

Pure ethane enters the flows reactor at 6 atm and 1100 K.

(b) The catalytic gas – phase oxidation



The feed enters at 6 atm and 260°C and is a stoichiometric mixture of air and Ethylene.
