DEPARTMENT OF CHEMICAL ENGINEERING

Minor-II

Chemical Reaction Engineering I (CLL 122)

Marks - 15

Venue: VI- LT 1 & 2

22nd March 2015

1.00 PM - 2.00 PM

Use separate answer booklet for each section.

Section A

1) A total of 157.7 L/min of metaxylene is being isomerized to a mixture of orthoxylene, metaxylene, and paraxylene in a reactor containing 28.32 m^3 of catalyst. The reaction is being carried out at 400 ^{0}C and 20 atm. Under these conditions, 37% of metaxylene fed to the reactor is isomerized. At a flow rate of 105.2 L/min, 50% of the metaxylene fed to the reactor is isomerised at the same temperature and pressure. Energy changes are negligible.

   It is now proposed that a second plant be built to process 350 L/min of metaxylene at the same temperature and pressure as described above. What size reactor (i.e., what volume of catalyst) is required if conversion in the new plant is to be 46% instead of 37%? Justify any assumptions made for the scale-up calculation. (6)

2) Consider the irreversible reaction A $\longrightarrow$ B, second order reaction in 'A' taking place in an isothermal tubular reactor, it would be of interest to predict the concentration variation of 'A' along the axial and radial direction. Please write the mathematical model in dimensionless form along with the boundary conditions to describe the concentration profile. Explain the contribution of each term. (5)

Section B

3) A reaction A$\rightarrow$ R+S is carried out in a constant volume batch reactor. The experiment was started with several initial concentrations and when half of the concentration was reached, the corresponding time was measured. Determine the order of the reaction and specific rate constant. (4)

C_{A0} (mol/l)	0.025	0.0133	0.010	0.05	0.075
$t_{1/2}$ (min)	4.1	7.7	9.8	1.96	1.3