CHEMICAL REACTION ENGINEERING - I (CLL 122)

MAJOR – PART A

Max marks: 15

Date: 8.05.2016

Venue: LH-121 and LH-325
Time: 3:30 – 5:30 pm

Q1. A first-order, gas-phase reaction A → B/2 is performed in a PBR at 450 K and 4 atm. Feed rate is 4 mol/s containing 10% A and the rest inerts. The PBR is packed with 10 mm diameter spherical porous particles. The intrinsic reaction rate is given as: $r'_A = 2*C_A$ mol/kg(cat)-s. Bulk density of the catalyst is 2.5 kg/liter. The pressure drop parameter alpha (α) is found to be 0.001 kg^{-1}. **(8)**

a. How much catalyst (kg) is required to obtain 15% conversion in the reactor?

b. Find the pressure at the exit of the reactor.

Differential form of Ergun equation for the pressure drop in packed beds is as follows:

$$\frac{dP}{dW} = -\frac{\alpha}{2}\frac{T}{T_o}\frac{P_o}{(P/P_o)})(1+\varepsilon X)$$

Q2. The conversion of an irreversible first-order, liquid-phase reaction, taking place in a PFR of 500 liter capacity is 50%. In order to increase conversion, a 300 liter CSTR is installed upstream of (before) the PFR. What is the exit conversion in the new system? **(7)**