CHEMICAL REACTION AND REACTOR ENGINEERING (CLL 122)
MAJOR - PART A

1) The following first-order reaction is taking place in a PBR.

$$A \rightarrow B$$

The reaction rate and the rate constant are given by:

$$-r_A' = kp_A \quad \left(\frac{mol}{kg\ cat - h}\right)$$

$$k = 0.75 \quad \frac{mol}{atm - kg\ cat - h}$$

$$p_a = atm$$

A is fed to the reactor with 50% inerts at 327°C and 1 atmosphere. Feed rate of A is 37.5 moles/h. The pressure drop parameter $a = 0.0045 kg^{-1}$. Obtain an expression that relates the conversion in the reactor to the weight of the catalyst used. State your assumptions. What conversion can you obtain with 100 kg of the catalyst? (10)

2) Consider the irreversible reaction $A \rightarrow B$, 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)