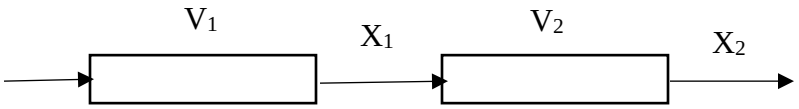
Class Test-2, Date 07-10-2021
Reaction Engineering
Marks: 20, Time:1 hr.

1. A polymerization reaction at 102^0 C is 1.5^{th} order of A (the monomer).The monomer is to be treated by two equal sized mixed reactor in series where the product contents of A is 20%. An increase in production is contemplated by a reactor similar to those being used. By what percentage can we increase the feed rate and still obtain a product containing no more than 20% monomer if the third reactor is connected in series after second reactor, and all the reactors become in series? [6]

2. Two plug flow reactors are connected in series, Calculate the reactor volume V_1 and V_2 when X_1 =0.4 and final conversion is X_2= 0.8. F_{A0} =0.4 mol/sec.



Reactor data:

X_A	0	0.1	0.2	0.4	0.6	0.7	0.8
$F_{A0}/-r_A$, m^3	0.89	1.08	1.33	2.05	3.54	5.06	8

[4]

3. (a)Show that at higher conversion, plug flow reactor is more advantageous than mixed reactor assuming 1^{st} order elementary liquid phase reaction. [2]
(b) What are the advantages of using multiple CSTR connecting in series? [2]
(c) For first-order liquid phase reaction, under identical condition at what conversion the volume of mixed reactors requires twice than that of the PFR volume? [4]
(d) Write the expression for Damkohler number as a function of final conversion for first-order reaction when 3-reactors are connected in series. [2]