



Sardar Beant Singh State University, Gurdaspur
Department of Chemical Engineering & Bio Technology

Assignment No.4

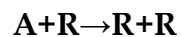
Subject: Chemical Reaction Engineering-I

Topic: **Recycle Reactors**

Q1. At present conversion is $2/3$ for our elementary second-order liquid reaction $2A \rightarrow 2R$ when operating in an isothermal plug flow reactor with a recycle ratio of unity. What will be the conversion if the recycle stream is shut off?

Q2. For an irreversible first-order liquid-phase reaction ($C_{A0} = 10$ mol/liter) conversion is 90% in a plug flow reactor. If two-thirds of the stream leaving the reactor is recycled to the reactor entrance, and if the throughput to the whole reactor-recycle system is kept unchanged, what does this do to the concentration of reactant leaving the system?

Q3. We wish to explore various reactor setups for the transformation of A into R. The feed contains 99% A, 1% R; the desired product is to consist of 10% A, 90% R. The transformation takes place by means of the elementary reaction having rate constant $k = 1$ liter/mol.min.



The concentration of active materials is throughout. $C_{A0}+C_{R0}=C_A+C_R=C_O=1$ mol/lit. What reactor holding time will yield a product in which $C_R = 0.9$ mol/liter (a) in a plug flow reactor, (b) in a mixed flow reactor, and (c) in a minimum-size setup without recycle?