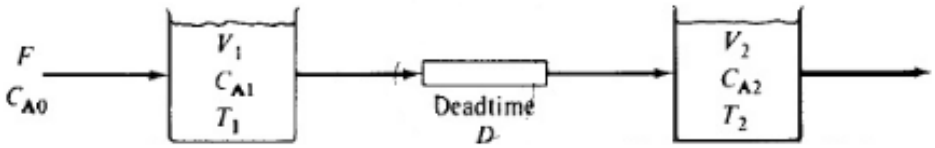
Department of Chemical Engineering
Tutorial Sheet .3

Subject: Chemical Process Simulation Semester: 7th, Chemical Engineering

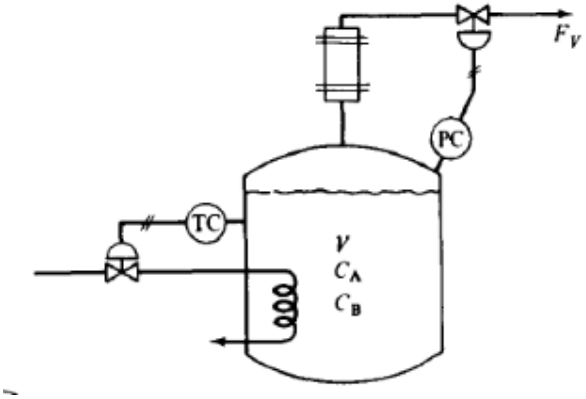
Q1. Consider the system that has two stirred chemical reactors separated by a plug-flow a dead time of D seconds. Assume constant holdups (V_1 and V_2,), constant throughput (F), constant density, isothermal operation at temperatures T_1 and T_2, and first- order kinetics with simultaneous reactions.

AŸ B, AŸ C k_1 and k_2 are rate constant of respective reaction
No reaction occurs in the plug-flow section. Write the equations describing the system.



Q2. The liquid in a jacketed, non-isothermal CSTR is stirred by an agitator whose mass is significant compared with the reaction mass. The mass of the reactor wall and the mass of the jacket wall are also significant. Write the energy equations for the system. Neglect radial temperature gradients in the agitator, reactor wall, and jacket wall.

Q3.The reaction 3A + 2B + C is carried out in an isothermal semi batch reactor. B is the desired product. Product C is a very volatile by-product that must be vented off to prevent a pressure buildup in the reactor. Gaseous C is vented off through a condenser to force any A and B back into the reactor to prevent loss of reactant and product.



Assume F_V, is pure C. The reaction is first-order in C_A. The relative volatilities of A and C to B are $\breve{U}_{AB}$ =1.2 and $\breve{U}_{CB}$ =10. . Assume perfect gases and constant pressure. Write the equations describing the system. List all assumptions.

Q4. An ice cube is dropped into a hot, perfectly mixed, insulated cup of coffee. Develop the equations describing the dynamics of the system. List all assumptions and define all terms.