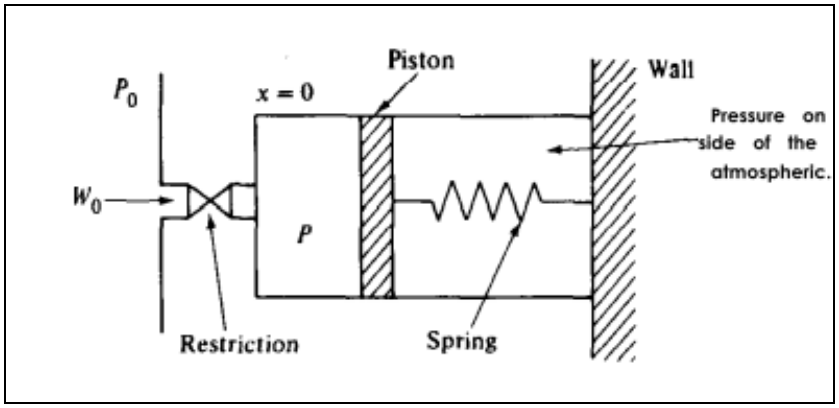
Department of Chemical Engineering
Subject: Process Modeling & Simulation : 7th
Assignment No.3

Topic: Semi Batch Reactor & Piston displacement
Last Date of Submission: 5th October 2016

Q1. A perfect gas with molecular weight M flows at W_0 into a cylinder through a restriction. The flow rate is proportional to square root of the pressure drop over the restriction. $W_0=k_0\tilde{a}P_0$-P, where P is the pressure in the cylinder and P) is constant upstream pressure. Piston enforced to right direction as pressure build up. A spring resists the movement of the piston with the force that is proportional to the axial displacement x of the piston



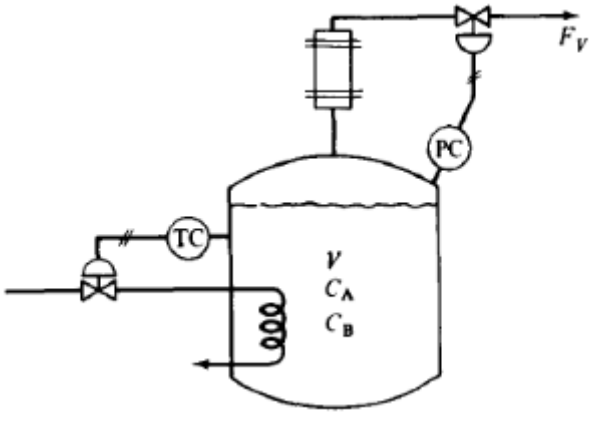
Q2. A semi batch reactor is run at constant temperature by varying the rate of addition of one of the reactants A. The irreversible exothermic reaction is first order in reactants A and B.

$A + B \xrightarrow{k} C$

The tank is initially filled to its 40% level with pure reactant B at the concentration C_{BO}. Maximum cooling water flow is begun, and reactant A is slowly added to the perfectly stirred vessel. Write the equations describing the system. Solving the equation, sketch the profile of FA, C_A and C_B with time during the batch cycle.

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.

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