Department of Chemical Engineering

CHL 261 Instrumentation & Process Control: Minor - I (closed book)

Duration: 1 hr | Max Marks: 20 | 2nd Sep 2013

Q1. Derive the Laplace transform of the periodic function shown in Fig 1. [4 M]

Q2. Derive the expression for finding the time constant of the liquid level system shown in Fig 2 with variable cross sectional area. The resistance R is linear. The tank has three vertical walls and one which slopes at an angle α from the vertical as shown. The distance separating the parallel walls is w. [4 M]

Q3. Consider a two-tank interacting system as shown in Fig 3 where R_1 is a nonlinear resistance and R_2 is a linear resistance. The valve characteristic for R_1 is $q_1 = 4\sqrt{h_1 - h_2}$. (a) Write the balances for each tank and derive the general expression for overall transfer function $\frac{H_2(s)}{Q(s)}$. (b) Determine $H_2(t)$ for a unit step change in Q(t), assuming $A_1=A_2=1$ and $R_1= R_2=1$. [12 M]

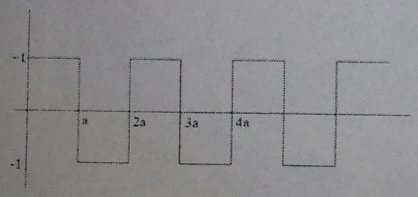

Fig 1. Periodic function

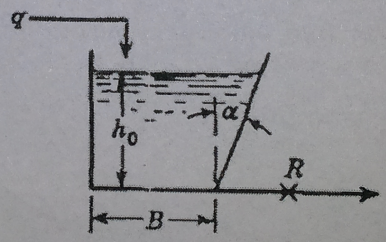

Fig 2. Liquid level system

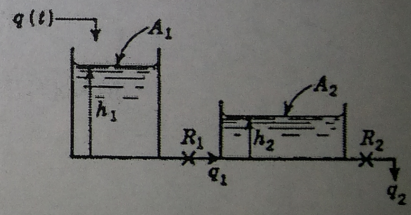

Fig 3. Two-tank interacting system