Process Control, 3P4 Your name: _____

Tutorial 3 Student number: _____

This tutorial, leading into assignment 2, has two main goals: become proficient at using the Laplace transform; and understanding more about sensors, an important

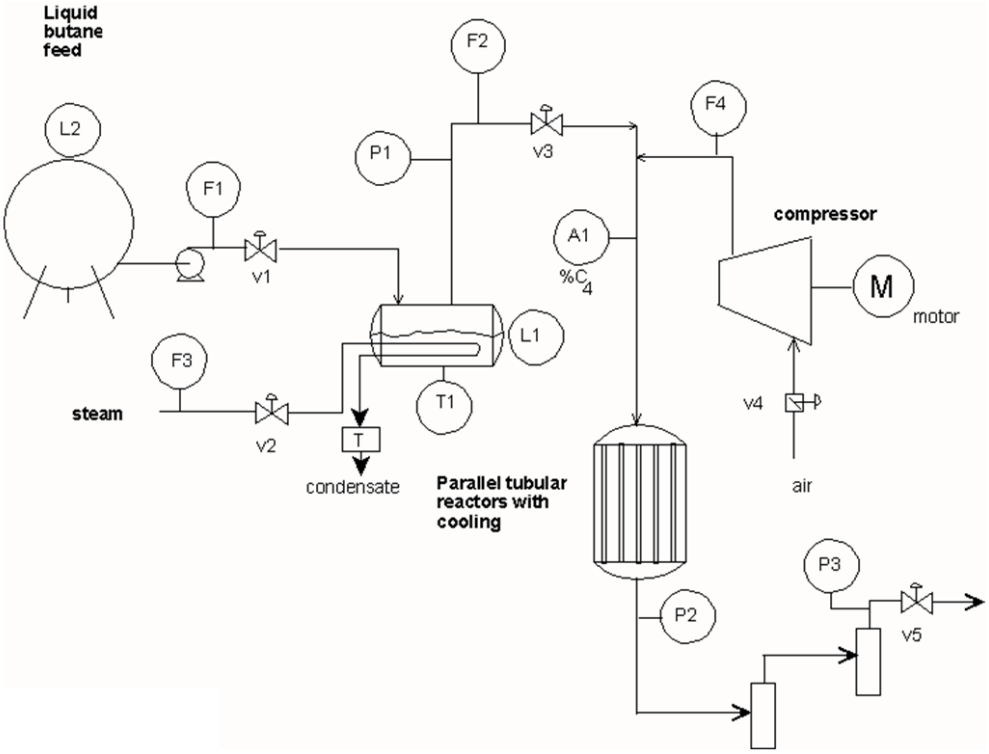
Question 1 [4]

Consider an earlier problem from class. If the height, h, in a tank is given by $\frac{dh}{dt} = F_i - \frac{h}{AR}$. The flow out of the tank is $F_\text{o} = \frac{h}{R}$; A is the cross sectional area, and R is a constant. Find the Laplace transform $H(s)$, but use deviation variables for h.

Question 2 [4]

Invert the Laplace transform and solve for $h(t) =$ [ ], given that $h(t = 0) = h_0$.

Question 3 [8]



This flowsheets shows the process where liquid butane is vapourized and combined with compressed air. You can see the butane holding tanks at 19 seconds into this YouTube video: http://bit.ly/19D2xrK

1. Identify 5 types of sensors in the flowsheet.
2. The aim is to control composition of butane, `A1`, very close to, but below the combustion limit, in the stream entering the reactor. This is a safety-critical control loop, so you must be able to move away from the combustion limit constraint *fast* if you get close to it! Which valve should you use?

Answers:

1. (a)

   (b)

   (c)

   (d)

   (e)

2. Opening valve _____ has a causal effect on `A1` because it will _____ (raise/lower) the percentage of butane entering the reactor. Explain why you selected the valve below.