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]

Partial fraction expansion is a topic you have learned about in your prior high school and university math courses.

$$Y(s) = \frac{s+5}{(s+1)(s+4)} = \frac{\alpha_1}{(s+1)} + \frac{\alpha_2}{(s+4)}$$

$\alpha_1 =$ $\alpha_2 =$

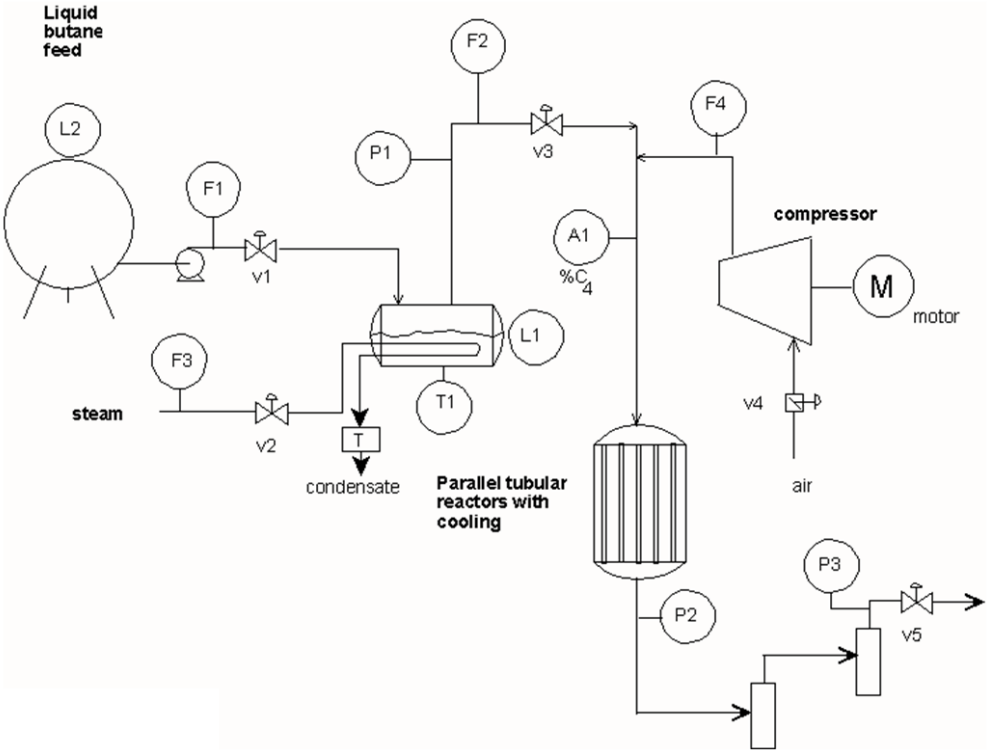
Question 2 [8]

Another one:

$$Y(s) = \frac{1}{s(s+4)(s+5)} = \frac{\alpha_1}{s} + \frac{\alpha_2}{(s+4)} + \frac{\alpha_3}{(s+5)}$$

$\alpha_1 =$ $\alpha_2 =$ $\alpha_3 =$ $\mathcal{L}^{-1}[Y(s)] = y(t) =$

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. I decide to use value valve _____ . If we open this valve, there us a causal effect on `A1` because it will _____ (raise/lower) the percentage of butane entering the reactor. Now explain below, giving several reasons, why you selected the valve.