THE UNIVERSITY OF TEXAS AT SAN ANTONIO

EE 3413

ANALYSIS AND DESIGN OF CONTROL SYSTEMS

HOMEWORK # 2

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The objective of this homework is to test your understanding of the content of Module 2—Laplace transforms, transfer functions, partial fraction expansion, and ODE solutions. Provide neat solutions, with well-written answers. You need to have the Laplace transform table around you when you're doing the homework. Due date of the homework is: **Thursday, January 28th, 2016.**

You have to upload a scanned version of your solutions on Blackboard. If you don't have a scanner around you, you can use Cam Scanner—a mobile app that scans images in a neat way, as if they're scanned through a copier. Here's the link for Cam Scanner: https://www.camscanner.com/user/download.

1. Using Laplace transforms, solve the following differential equation for $y(t)$:

$$y'(t) - y(t) = e^{3t},$$

   given that the initial value for $y(t)$ is $y(0) = 2$.

2. Using Laplace transforms, solve the following differential equation for $y(t)$:

$$y''(t) - 10y'(t) + 9y(t) = 5t,$$

   given that $y(0) = -1$ and $y'(0) = 2$. Verify your answers on MATLAB via the `ilaplace` command.

3. For this differential equation:

$$y''(t) - 6y'(t) + 15y(t) = 2u(t),$$

   solve the following problems:

   (a) The transfer function $\dfrac{Y(s)}{U(s)}$.

   (b) The poles and zeros (if any) of the transfer function.

   (c) Given that $u(t) = \sin(3t), y(0) = -1, y'(0) = -4$, find $y(t)$ using partial fraction expansion. You might need to solve multiple linear equations with multiple unknowns. Do not panic.

   (d) Verify your answers on MATLAB via the `ilaplace` command.