

## Homework 6

**Submission Deadline: April 21, 2017 11:59 PM**

### Instructions:

- i) Submit on Blackboard before the mentioned deadline.**
- ii) No collaboration is allowed for any problems.**
- iii) The points allotted for each problem is noted alongside.**
- iv) For MATLAB problems, submit relevant codes and plots.**

1. Consider a system with transfer function

$$H(s) = \frac{1}{s^2 + 7s + 12}$$

- i) Find unit step response. (10 points)
- ii) Find the response for  $x(t) = \cos(6\pi t)$  (10 points)

2. Consider a unity gain feedback system with forward path

$$H_1(s) = \frac{1}{s^2 - 3s + 1}$$

- i) Find the steady state error as well as the response for unit step input. Plot input and output on the same graph. (10 points)
- ii) Find the steady state error as well as the response for ramp input. Plot input and output on the same graph. (10 points)

3. Draw the parallel as well as cascade realization for:

$$H(s) = \frac{s-2}{(s+3)(s+1)} \quad (10 \text{ points})$$

## MATLAB Problem

4. Use MATLAB's residue function to perform partial fraction expansion for the following. What are the residues and corresponding poles? (10 points)

i)  $H(s) = \frac{s+2}{s^2+11s+30}$

ii)  $H(s) = \frac{s+2}{s^2(s^2+11s+30)}$

5. Refer to Section 13.5 on your book. (5X3 =15 points)  
For a system with transfer function

$$H(s) = \frac{(s+3)}{(s+1)(s^2+9)}$$

- i) Using MATLAB's tf function, create a system from the transfer function
- ii) Using MATLAB's rlocus function, find the root locus plot of this system. Submit the plot.
- iii) Using the given  $H(s)$  as the forward path, a feedback system is designed with  $H_2(s) = 3$ . Use MATLAB's feedback function, to find the new overall transfer function.