EE3210 Signals & Systems

Due on Noon, 12:00 PM, May 10, 2020

Homework #3

1. Total mark is 20 points (= 4 points per problem × 5 problems)
2. Solution will be posted on May 12 on Canvas website
3. Submission due by May 10, 2020, noon.
4. Online submission through Canvas
   - Scan or taking a photo of your anwser sheet, then upload to Canvas
   - After initial submission to Canvas, you can resubmit through email to yjchun@cityu.edu.hk
     – For revision purpose or if the submitted file is corrupted

Problem 1

(Laplace Transform) Consider an LTI system with the following system function $H(s)$

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

a) Draw the pole-zero diagram and indicate all possible ROC that can be associaated with this diagram.

b) For each ROC, specify whether the associated system is stable and/or causal.

Problem 2

(Laplace Transform) Use the uni-lateral Laplace transform to solve the following problems.

a) Find the system output $y(t)$ for a given input $x(t) = e^{-4t}u(t)$

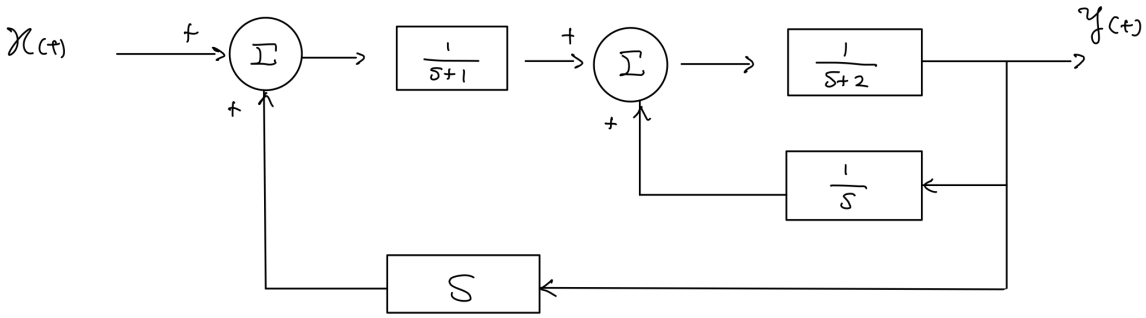
$$\frac{d^2y(t)}{dt^2} + 5\frac{dy(t)}{dt} + 6y(t) = \frac{dx(t)}{dt} + x(t), \quad y\left(0^-\right) = 2, \quad y^{'}\left(0^-\right) = 1$$

b) Solve the following integral equation

$$y(t) = 2 + 2\int_0^t y\left(\tau\right) d\tau, \quad t \geq 0$$

Problem 3

(Laplace Transform) Determine the overall system function $H(s)$ for the following system model



Problem 4

(Z-Transform) Find the inverse Z-Transform of the given $X(z)$

a)

$$X(z) = \frac{3}{Z-3}, \quad |Z| > 3$$

b)

$$X(z) = \frac{1}{(1-4Z^{-1})^2}, \quad |Z| > 4$$

Problem 5

(Z-Transform) Determine whether the LTI system is causal and/or stable for the given system function $H(z)$

a)

$$H(z) = \frac{1 - \frac{4}{3}Z^{-1} + \frac{1}{2}Z^{-2}}{Z^{-1}\left(1 - \frac{1}{2}Z^{-1}\right)\left(1 - \frac{1}{3}Z^{-1}\right)}$$

b)

$$H(z) = \frac{Z - \frac{1}{2}}{Z^2 + \frac{1}{2}Z - \frac{3}{16}}$$