

### Homework Assignment #1

1. Find the differential equation relating  $y(t)$  and  $x(t)$  if

$$\frac{Y(s)}{X(s)} = \frac{2.5s}{3s^3 + 2s^2 - 4s + 1}.$$

2. Find the system transfer function

$$H(s) = \frac{Y(s)}{X(s)}$$

if the input  $x(t)$  and the output  $y(t)$  of the system are related by the equation

$$\dot{y}(t) + 3y(t) = x(t) - \int_0^t x(\tau) d\tau.$$

Assume  $y(0) = 0$ . (Hint: Take the Laplace transform of the equation.)

3. Solve the differential equation

$$\ddot{y}(t) = 2\dot{y}(t) - y(t) + 2u(t)$$

with initial conditions  $y(0) = \dot{y}(0) = 0$ , where  $u(t)$  is the unit step input

$$u(t) = \begin{cases} 1, & t \geq 0 \\ 0, & t < 0 \end{cases}.$$

4. For the RC network shown, find the transfer function  $V_{out}(s)/V_{in}(s)$  and sketch the frequency response magnitude plot.

