

## Homework 2

### Question 1

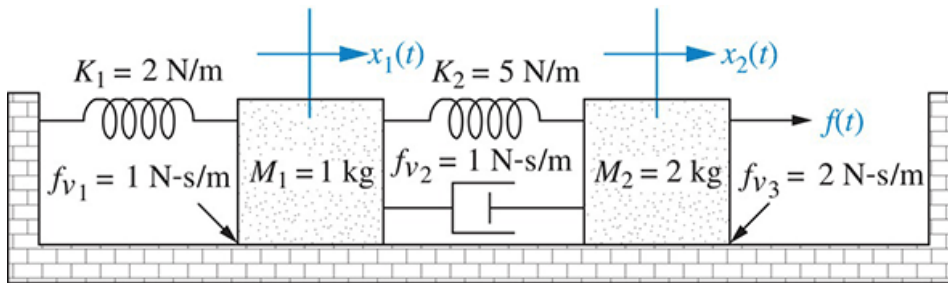
Solve the following differential equations using classical methods. Assume zero initial conditions.

$$\frac{d^2x}{dt^2} + 6\frac{dx}{dt} + 20x = 5u(t)$$

Repeat the question using Laplace transform, assuming zero initial conditions.

## Question 2

Find the transfer function,  $G(s) = X_2(s)/F(s)$ , for the system shown below:



**Question 3**

Represent the following transfer function in state space.

$$T(s) = \frac{s(s + 2)}{(s + 1)(s^2 + 2s + 5)}$$

#### Questions 4

Find the transfer function  $G(s) = \frac{Y(s)}{R(s)}$  for the following system represented in state space:

$$\dot{\mathbf{x}} = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -3 & -2 & -5 \end{bmatrix} \mathbf{x} + \begin{bmatrix} 0 \\ 0 \\ 10 \end{bmatrix} r$$

$$y = [1 \ 0 \ 0] \mathbf{x}$$