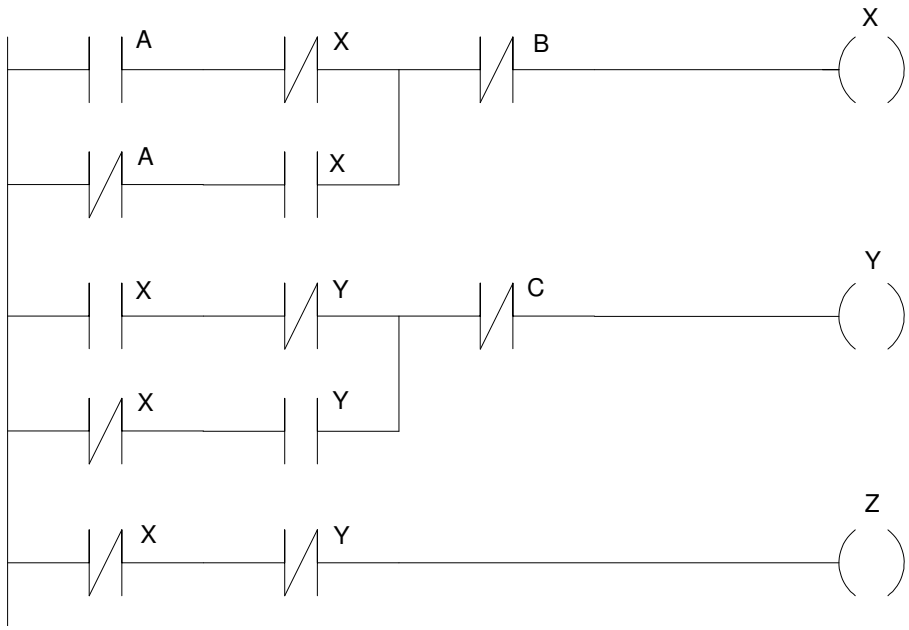
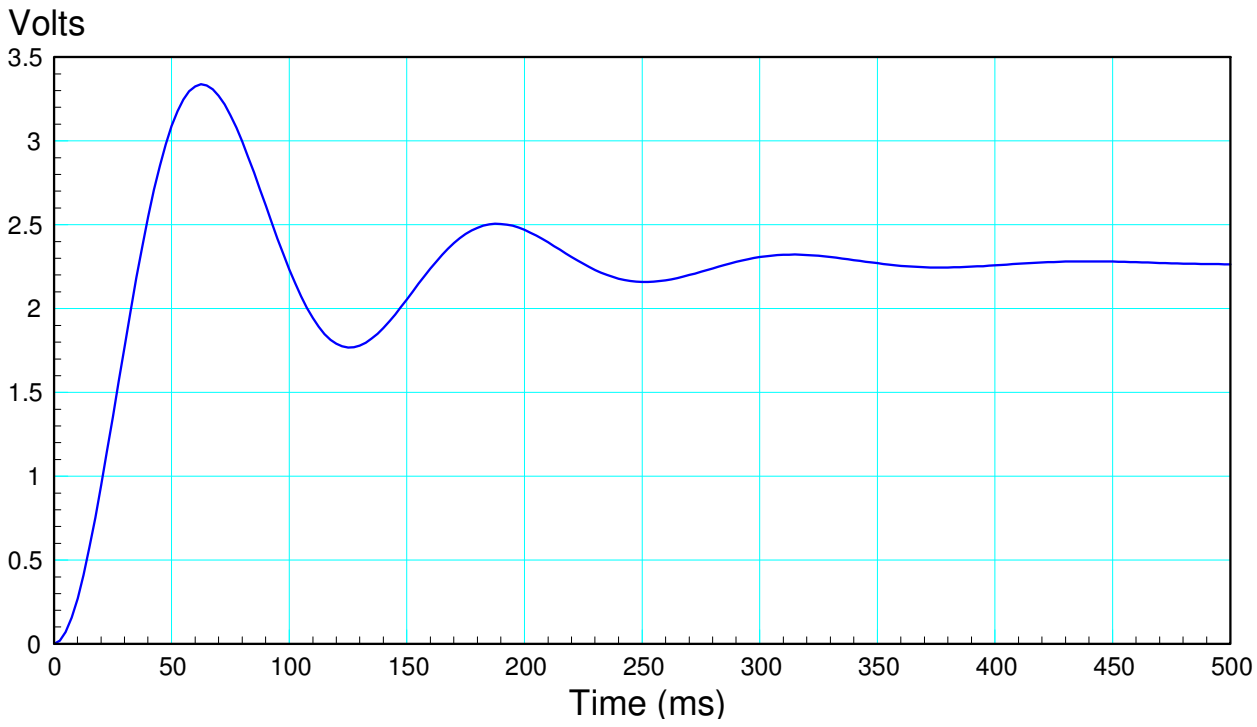
ECE 461/661 - Test #1: Name _____

Fall 2025

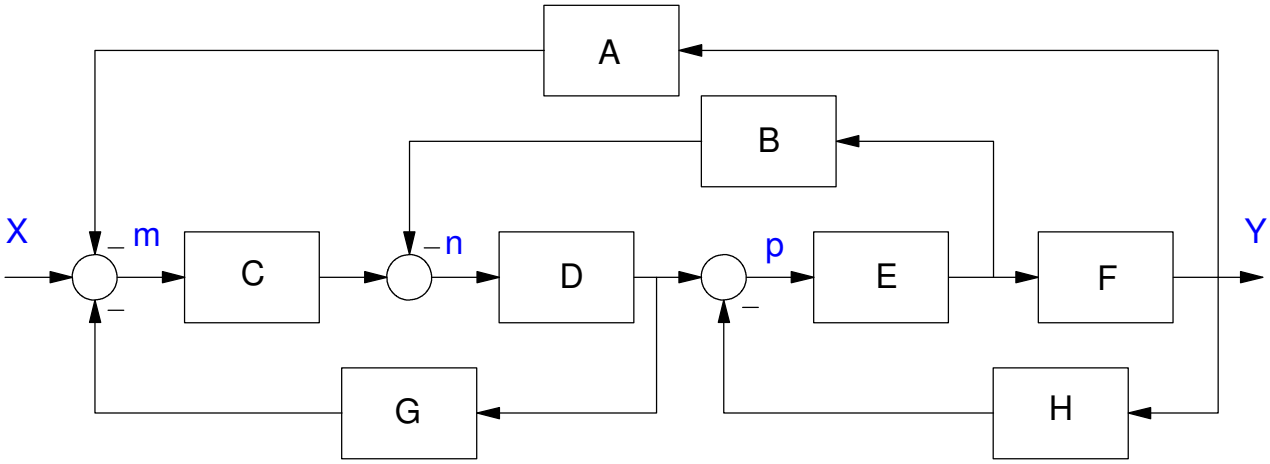
1) Determine the functions for X, Y, and Z according to the following ladder diagram. (you don't need to simplify)



2) Give the transfer function for a system with the following response to a unit step input:

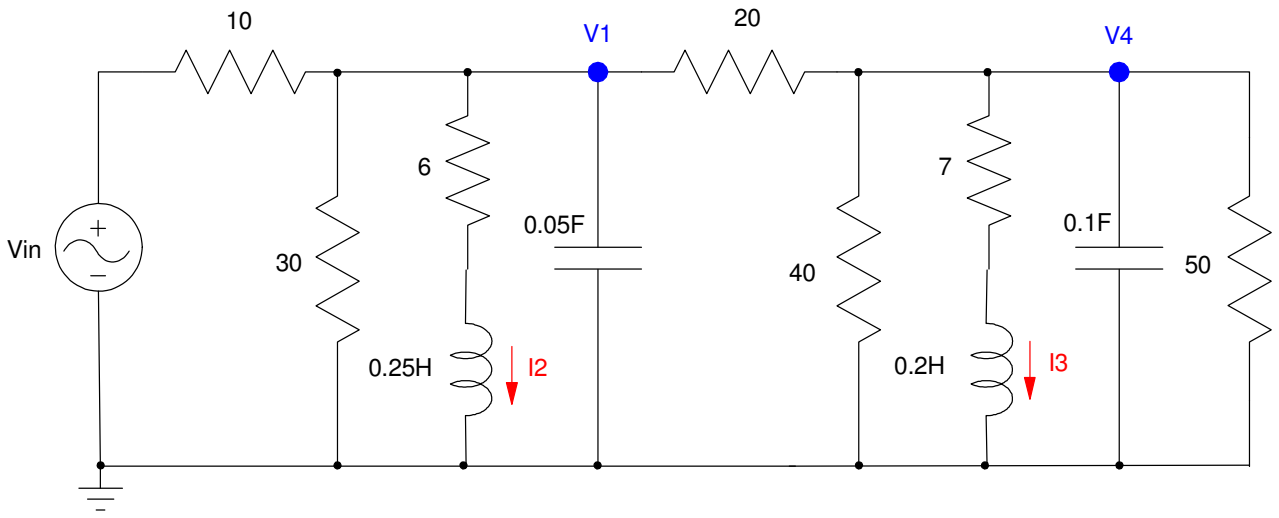


3) Find the transfer funciton from X to Y



4) For the following RLC circuit:

- Write the dynamics of this system as four compled differential equations in terms of {Vin, V1, I2, I3, V4}
- You don't need to solve or put in state-space form (that's a different problem on the test)



5) Assume the dynamics of an RLC circuit are:

$$0.5sI_1 = -2I_1 + (V_{in} - V_2) + 3I_3$$

$$0.1sV_2 = 0.4I_1 - \left(\frac{V_{in} - V_2}{6}\right) - 5I_3$$

$$0.2sI_3 = I_1 - 2I_3$$

$$Y = 7V_2 - 8I_1$$

- Give the state-space representation for the dynamics.

$$s\begin{bmatrix} I_1 \\ V_2 \\ I_3 \end{bmatrix} = \begin{bmatrix} \_\_\_\_ & \_\_\_\_ & \_\_\_\_ \\ \_\_\_\_ & \_\_\_\_ & \_\_\_\_ \\ \_\_\_\_ & \_\_\_\_ & \_\_\_\_ \end{bmatrix}\begin{bmatrix} I_1 \\ V_2 \\ I_3 \end{bmatrix} + \begin{bmatrix} \_\_\_\_ \\ \_\_\_\_ \\ \_\_\_\_ \end{bmatrix} V_{in}$$

$$Y = \begin{bmatrix} \_\_\_\_ & \_\_\_\_ & \_\_\_\_ \end{bmatrix}\begin{bmatrix} I_1 \\ V_2 \\ I_3 \end{bmatrix} + [\_\_\_\_]V_{in}$$