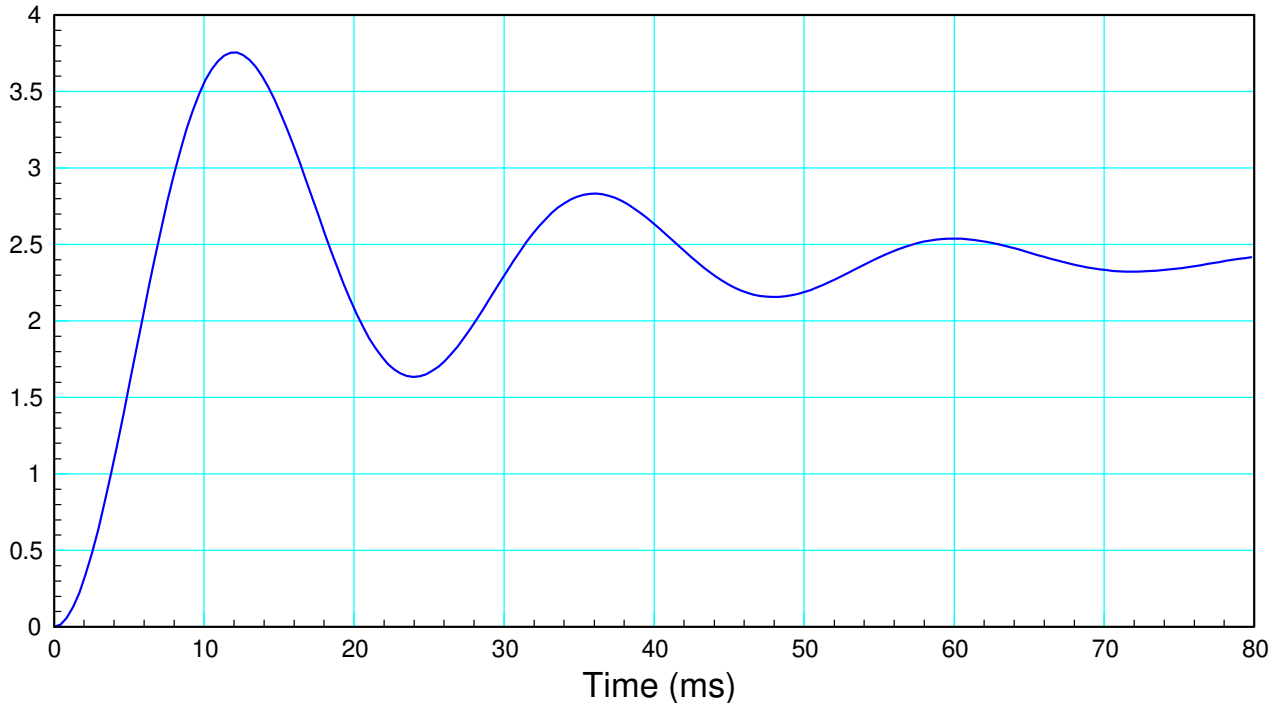
CE 463/663: Test #1. Name _____

Spring 2022. Open Book, Open Notes. Calculators & Matlab allowed. Individual Effort

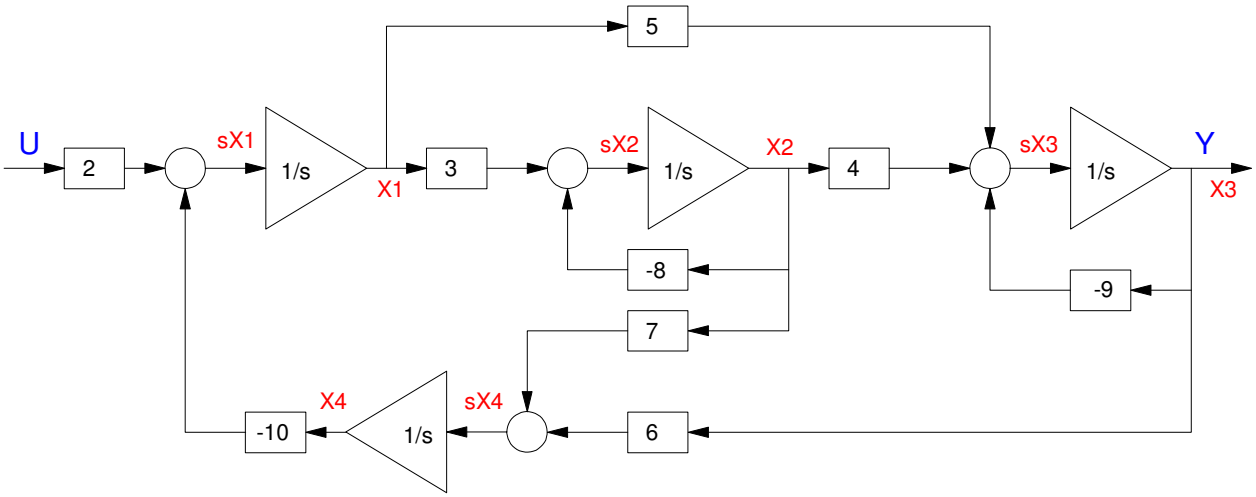
1) Find the transfer funciton for a system with the following step response

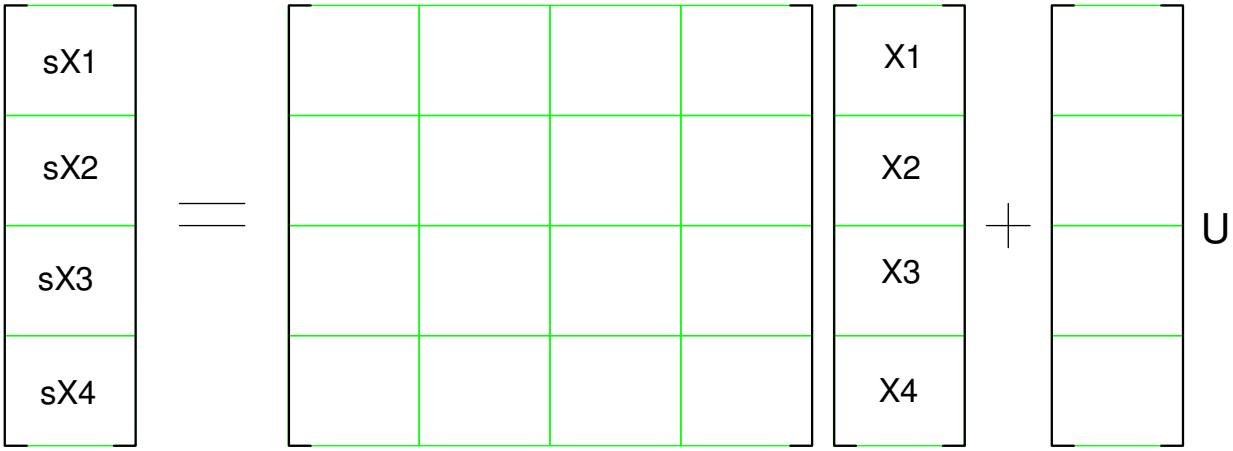


2) Determine a 2nd-order system which has approximately the same step response as the following 7th-order system

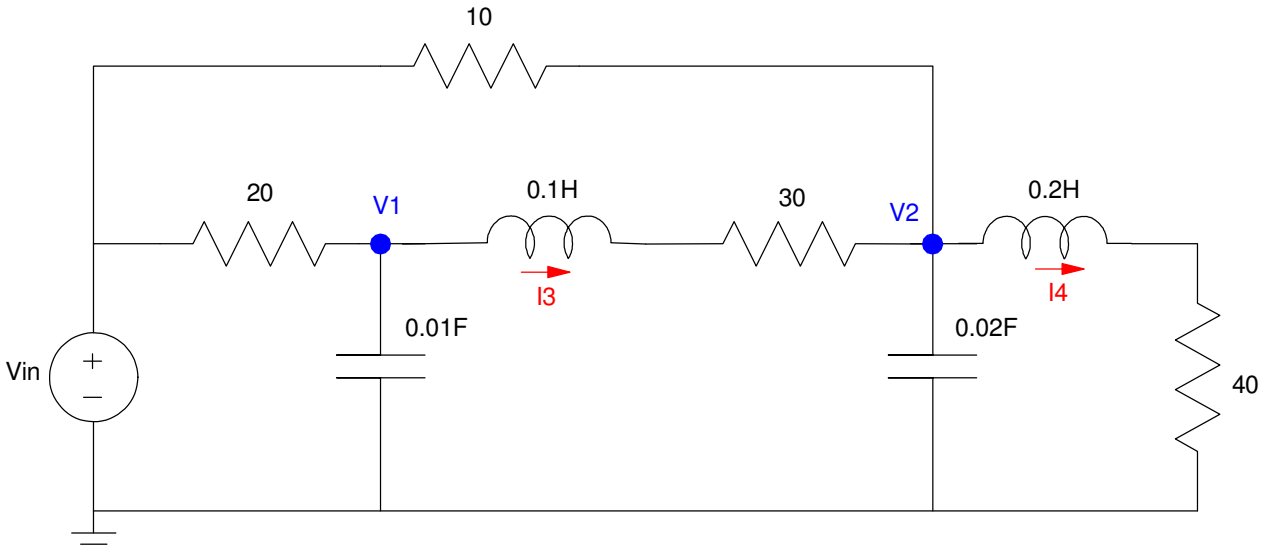
$$Y = \left(\frac{10{,}000}{(s+0.2)(s+1)(s+3)(s+5)(s+8)(s+10)(s+12)} \right) X$$

3) Give {A and B} for the the state-space model for the following system





4a) Write four coupled differential equations to describe the following circuit



4b) Express the A and B matricies for the dynamics in state-space form

$$\begin{bmatrix} sV1 \\ sV2 \\ sI3 \\ sI4 \end{bmatrix} = \begin{bmatrix} & & & \\ & & & \\ & & & \\ & & & \end{bmatrix} \begin{bmatrix} V1 \\ V2 \\ I3 \\ I4 \end{bmatrix} + \begin{bmatrix} & \\ & \\ & \\ & \end{bmatrix} Vin$$

5) Assume the LaGrangian is:

$$L = 4x^2\dot{x}^3\dot{\theta}^2 + 5x\dot{x}\cos(\theta) - 2g\sin(\theta)$$

Determine

$$F = \frac{d}{dt}\left(\frac{\partial L}{\partial \dot{x}}\right) - \left(\frac{\partial L}{\partial x}\right)$$