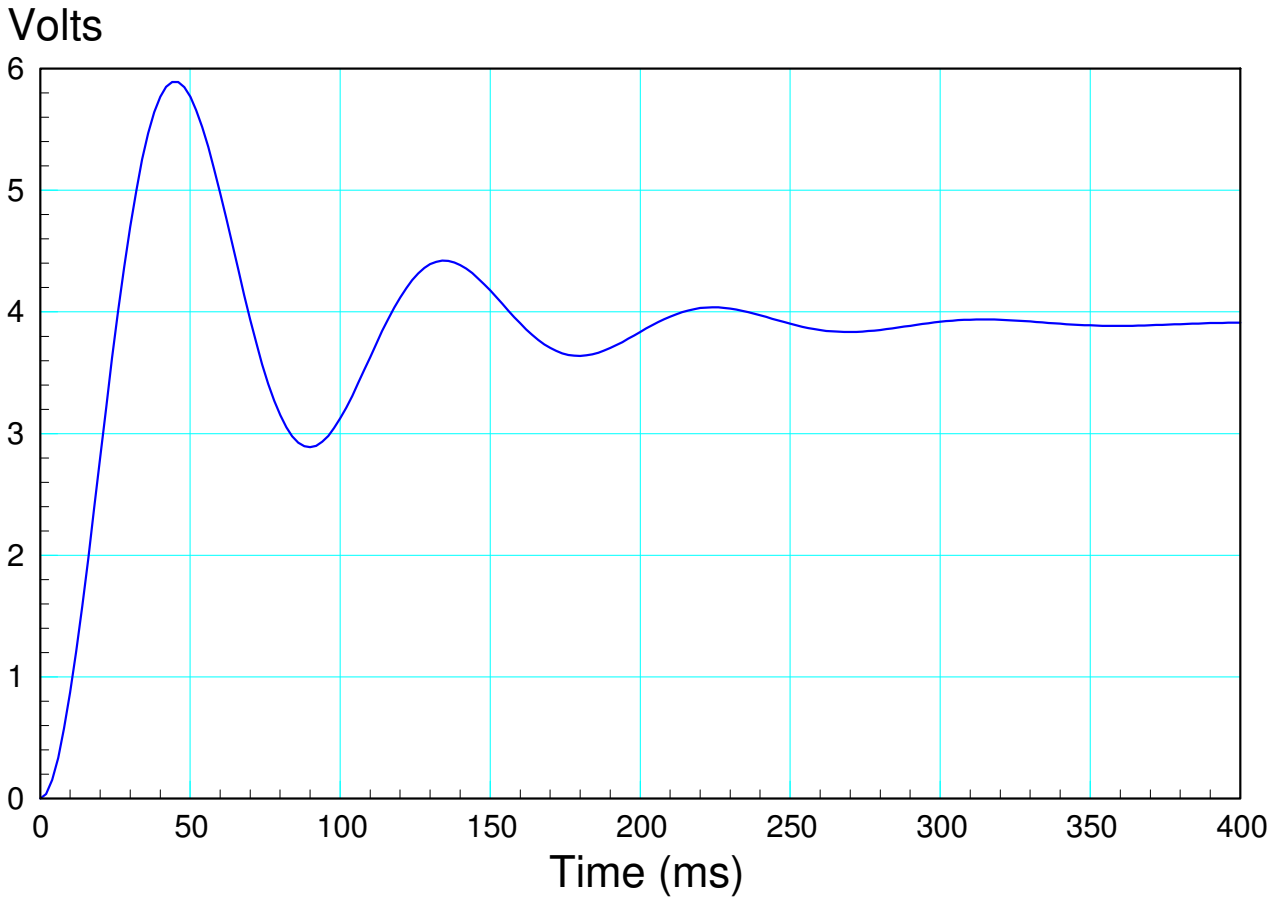
ECE 463/663: Test #1. Name _____

Spring 2024. Calculators allowed. Individual Effort

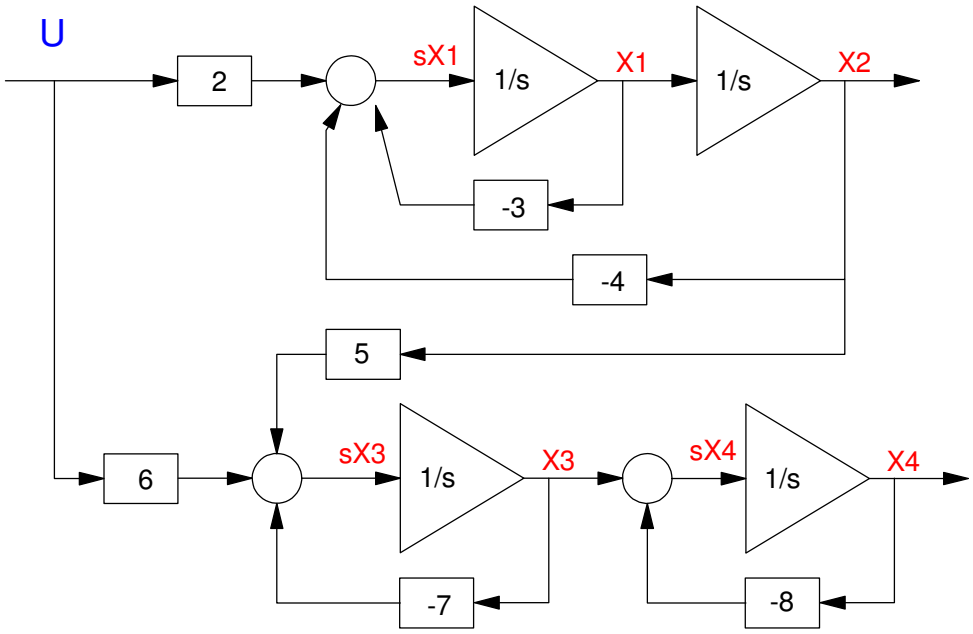
1) Find the transfer funciton for a system with the following step response

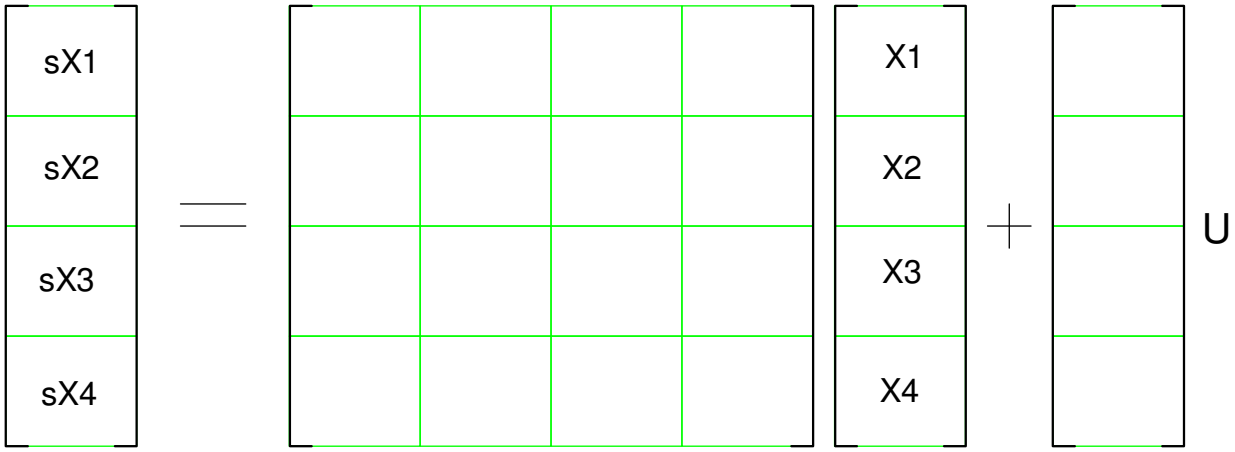


2) Determine a 2nd-order system which has approximately the same step response as the following system

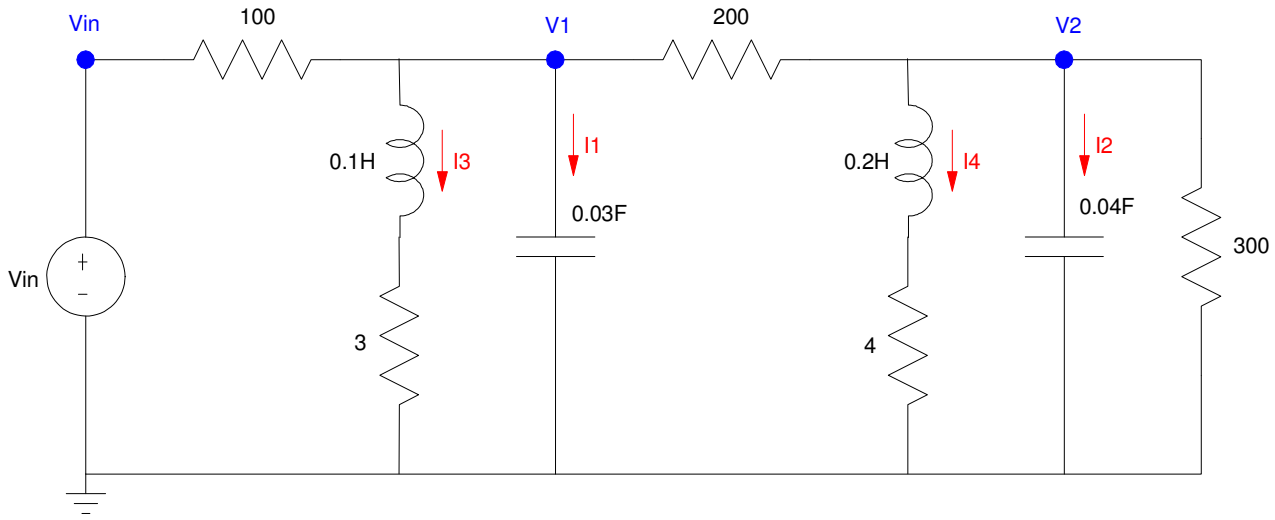
$$Y = \left(\frac{50{,}000(s+2)(s+30)}{(s+3+j5)(s+3-j5)(s+22)(s+35)(s+40)} \right) X$$

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





4) Write four coupled differential equations to describe the following circuit. Assume the states are {V1, V2, I3, I4}. Note: For capacitors: $I = C\frac{dV}{dt}$, For inductors: $V = L\frac{dI}{dt}$



5) Assume the LaGrangian is:

$$L = 2x\cos(x)\dot{x}^2 + 3x\dot{x}\sin(\theta) + 7\cos(2\theta)\dot{\theta}^2$$

Determine

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