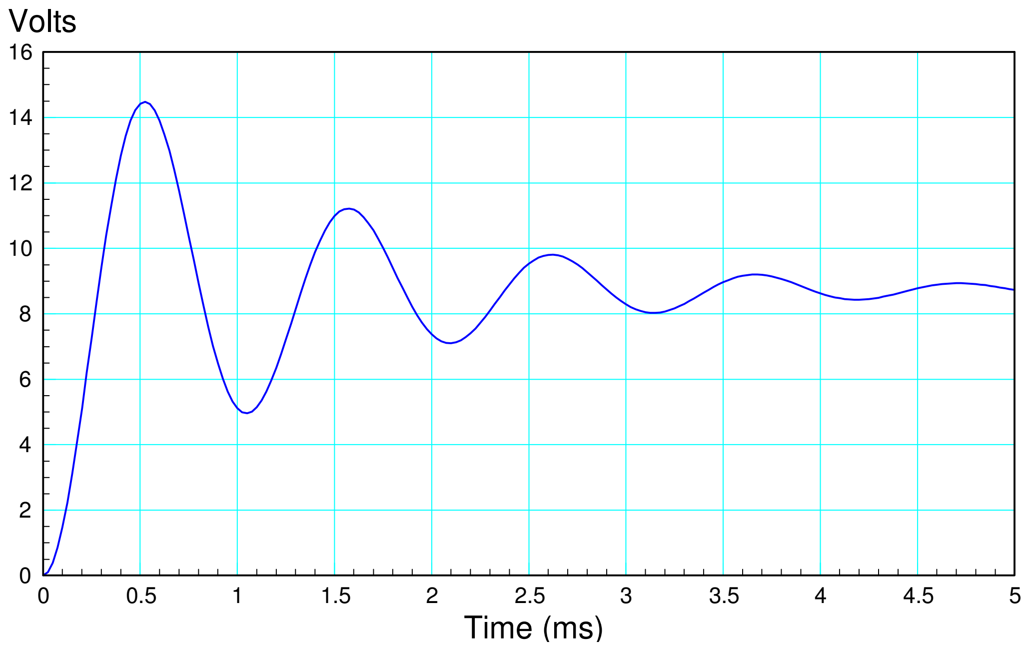
ECE 461 - Final: Name ____________________

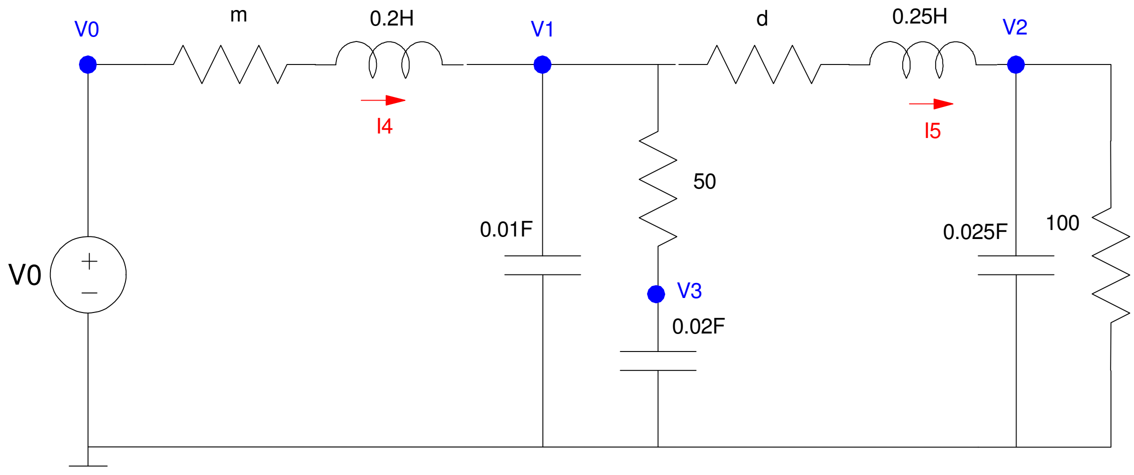
Fall - 2024

1) Give the transfer function for a system with the following step response:



2) Write the differential equations which describe the following circuit (i.e. write the N differential equations which correspond to the voltage node equations). Assume

- m is your birth month (1..12) Ohms
- d is your birth date (1..31) Ohms

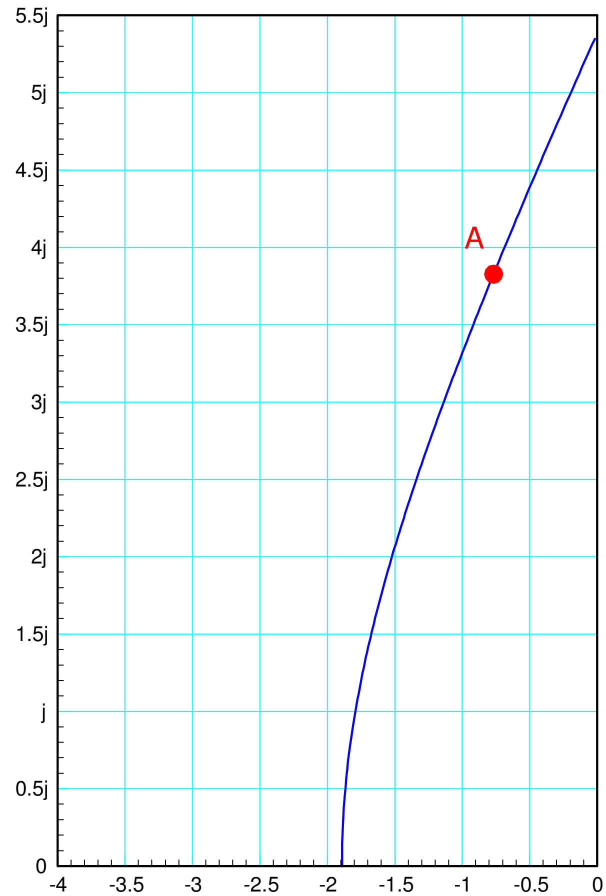


3) The root locus for

$$G(s) = \left(\frac{5}{(s+0.5)(s+4)(s+6)}\right)$$

is shown to the right. Determine the following:

A value of point A x + jy	
k for placing the closed-loop pole at A	
Resulting 2% settling time	
Resulting % Overshoot	
Resulting Error Constant (kp)	



4) Given the following stable system where 'd' is your birth date (1..31) and m is your birth month (1..12).

$$G(s) = \left(\frac{5+d}{(s+0.5)(s+2)(s+m)} \right)$$

Determine a compensator, K(s), which results in the closed-loop system having

- No error for a step input, and
- A closed-loop dominant pole at s = -3 + j4

5) Given the following stable system where 'd' is your birth date (1..31) and m is your birth month (1..12).

$$G(s) = \left(\frac{5+d}{(s+0.5)(s+2)(s+m)} \right)$$

Determine a digital compensator, K(z), which results in the closed-loop system having

- No error for a step input,
- A closed-loop dominant pole at s = -3 + j4 (z = 0.682 + j0.288), and
- A sampling rate of T = 0.1

6) Given the following stable system where 'd' is your birth date (1..31) and m is your birth month (1..12).

$$G(s) = \left(\frac{5+d}{(s+0.5)(s+2)(s+m)} \right)$$

Determine a compensator, K(s), which results in the closed-loop system having

- A closed-loop DC gain of 1.000 (i.e. no error for a step input),
- A 0dB gain frequency of 4 rad/sec, and
- A phase margin of 57 degrees