(Fall 2016) ELEC 341 Quiz #1

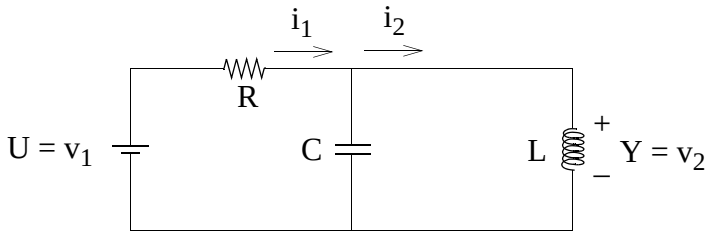
Instructions:

- You have **45 minutes** to complete this quiz.
- You **MAY** use a formula sheet and calculator.
- You **MUST** show your work in your booklet.
- You **MUST** write your answer on this paper.

Name:

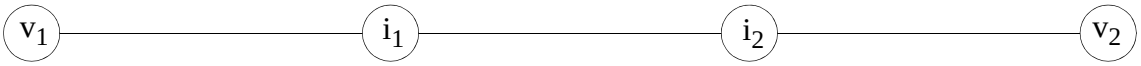
S/N:

1 - (5 marks) Use circuit analysis techniques to compute the transfer function.



$$\frac{Y}{U} = \frac{v_2}{v_1} =$$

2 - (10 marks) Convert the circuit into an equivalent Signal Flow Graph.



3 - (10 marks) Use Mason's Gain Formula the Signal Flow Graph to verify your answer in Question #1.

☐ Done - see work in booklet

4 - (10 marks) Redraw the Signal Flow Graph as a Block Diagram. Label i_1 and i_2.

5 - (10 marks) Use Block Diagram Manipulation to verify your answers in Questions #1 and #3.

☐ Done - see work in booklet

(Fall 2016) ELEC 341 Quiz #2

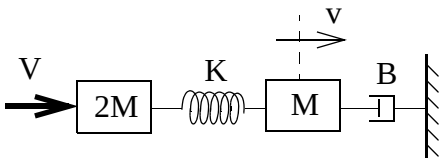
Instructions:

- You have **45 minutes** to complete this quiz.
- You **MAY** use a formula sheet and calculator.
- You **MUST** show your work in your booklet.
- You **MUST** write your answer on this paper.

Name:

S/N:

1 - (5 marks) For the following SISO (V is input, v is output) mechanical system, draw the equivalent electrical circuit. Label it using electrical symbols (V, v, R, L, C).



circuit:

2 - (4 marks) Compute the transfer function T=v/V of the ELECTRICAL system and represent it in NORMALIZED form.

$$T(s) = \frac{v(s)}{V(s)} =$$

3 - (2 marks) Compute the transfer function T=v/V of the MECHANICAL system (V, v, B, K, M) and represent it in NORMALIZED form.

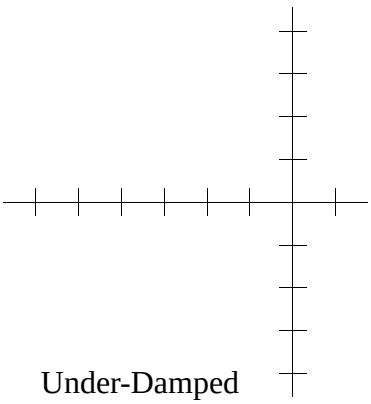
$$T(s) = \frac{v(s)}{V(s)} =$$

4 - (5 marks) Compute the following values from the MECHANICAL system transfer function. Reduce the terms as much as possible. Compute final value for the NATURAL response.

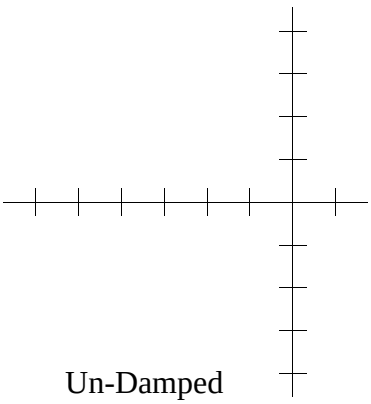
$\zeta =$ $a =$ $K_{DC} =$

$\omega_n =$ $\omega =$ $FV =$

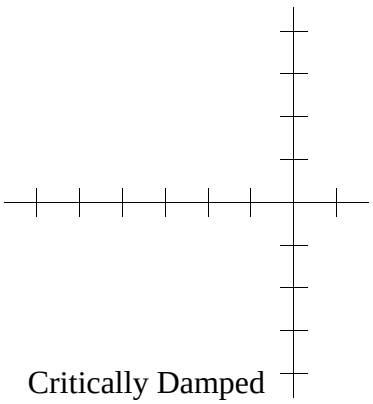
5 - (9 marks) Plot the poles and zeros assuming that the system is as labeled on each set of axes. Label all real and imaginary values and indicate both ω and ω_n on each pole/zero plot.



Under-Damped



Un-Damped



Critically Damped

(Fall 2016) ELEC 341 Quiz #3

Instructions:

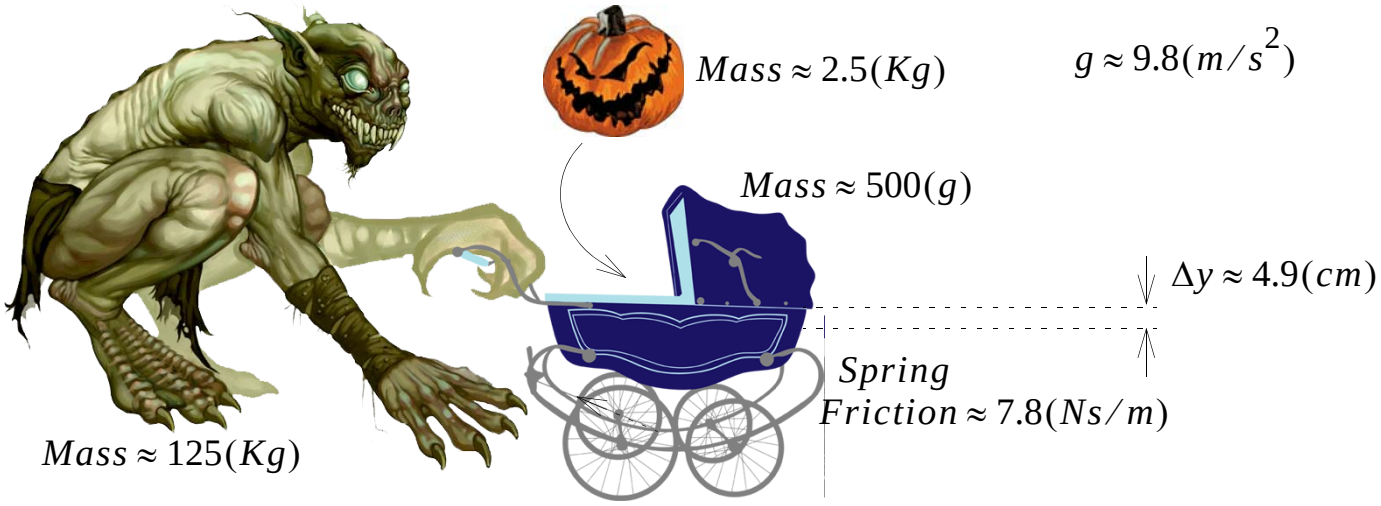
- You have **45 minutes** to complete this quiz.
- You **MAY** use a formula sheet and calculator.
- You **MUST** show your work in your booklet.
- You **MUST** write your answer on this paper.

Name:

S/N:

A deranged ghoul wishes to discretely transport an evil pumpkin, for sinister reasons that are best left un-said. He uses a delapitated baby carriage to conceal his wicked cargo. The basket of the baby carriage is supported on a suspension comprised of a squeeky spring. After placing the evil pumpkin into the baby carriage, the suspension compresses by the amount indicated.

Provide all answers to 2 significant figures.



1 - (10 marks) Draw the equivalent mechanical system model of the baby carriage carrying the evil pumpkin. Compute the values of all associated masses, springs, dampers and applied forces.

2 - (10 marks) Compute the normalized transfer function.

$$\frac{Y(s)}{F(s)} =$$

3 - (10 marks) After the evil pumpkin is placed in the baby carriage, how long does it take before the baby carriage stops bouncing around? At what frequency does it bounce?

$Time =$

$Freq =$

4 - (10 marks) The baby carriage is old and worn out and the suspension bottoms out if a 4.5 Kg mass is placed inside it. Does it ever bottom-out, even just for a moment, after the evil pumpkin is placed inside it? Prove it.

Bottom out? yes / no See booklet for proof

5 - (10 marks) How much is the motion affected by changes to the size of the evil pumpkin placed inside it? Is it affected more at high frequencies or at low frequencies?

Sensitivity is higher at: low freq / high freq See booklet for proof

(Fall 2016) ELEC 341 Quiz #4

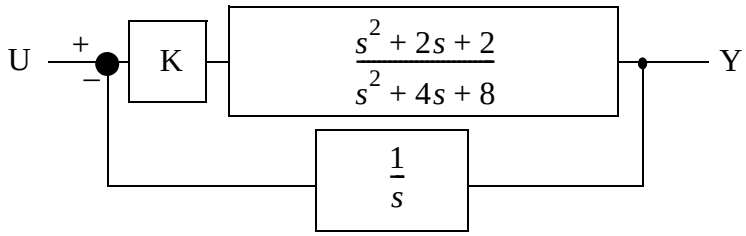
Instructions:

- You have **45 minutes** to complete this quiz.
- You **MAY** use a formula sheet and calculator.
- You **MUST** show your work in your booklet.
- You **MUST** write your answer on this paper.

Name:

S/N:

1 - (3 marks) For the following system, compute and plot the closed-loop poles & zeros when K=0.



2 - (1 marks) Identify the parts of the real axis for which the root locus exists.

Real parts =

3 - (1 marks) Compute the assymptote angles and assymptote centre.

θ_A =

4 - (2 marks) The root locus has two breakpoints at (s = -1.2, -3.2). Are there any others? If so how many? Do not compute the breakpoints. Just show how you figured out how many there should be.

Total number of BP =

5 - (2 marks) Compute the departure angles and sketch them on your worksheet.

Departure Angles =

6 - (2 marks) Compute the arrival angles and sketch them on your worksheet.

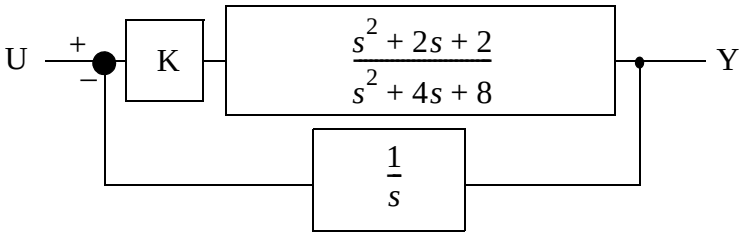
Arrival Angles =

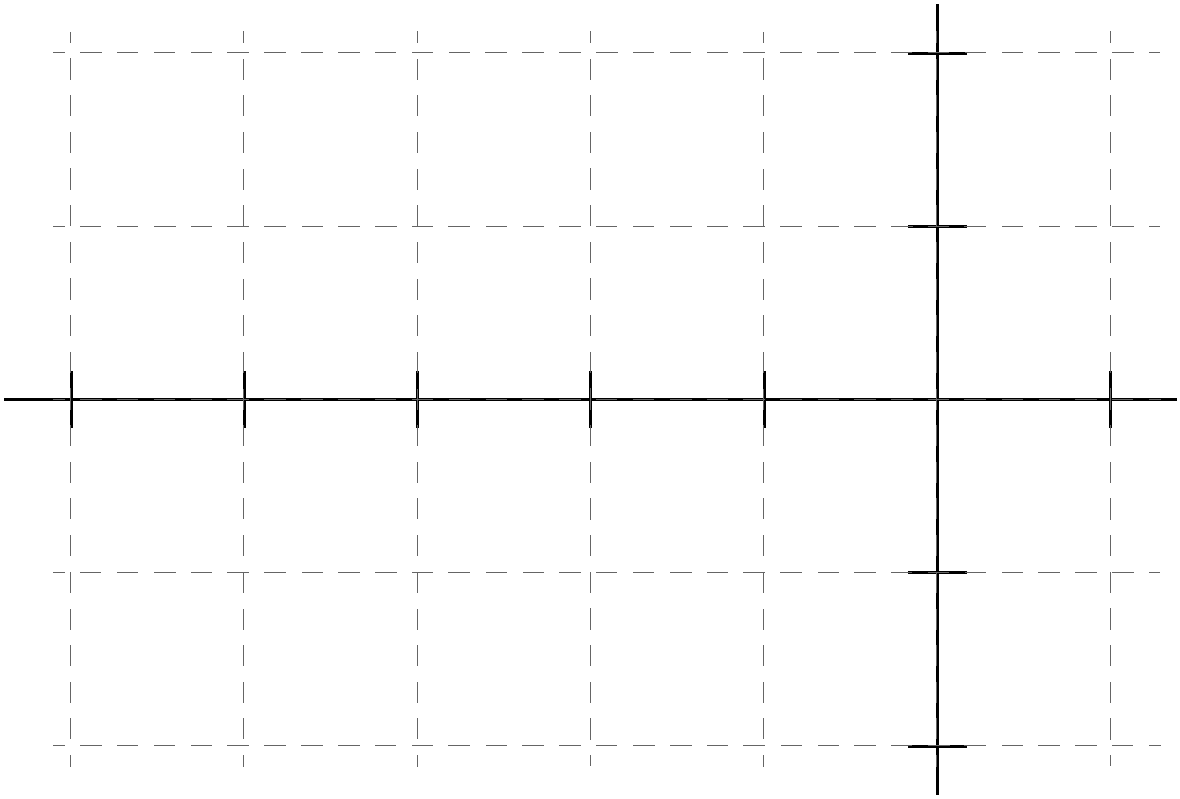
7 - (1 marks) Compute the range of K for stability. Hint: complete part 8 before ansering this just in case you notice a very easy way to find the answer.

K (stable) =

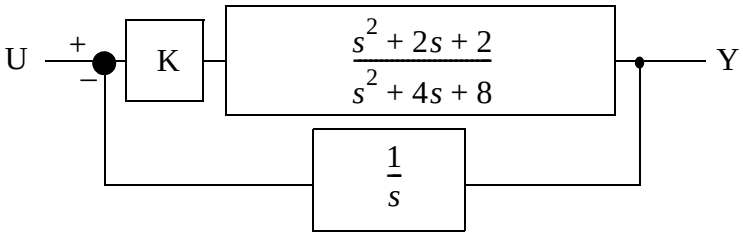
8 - (3 marks) Sketch the root locus.

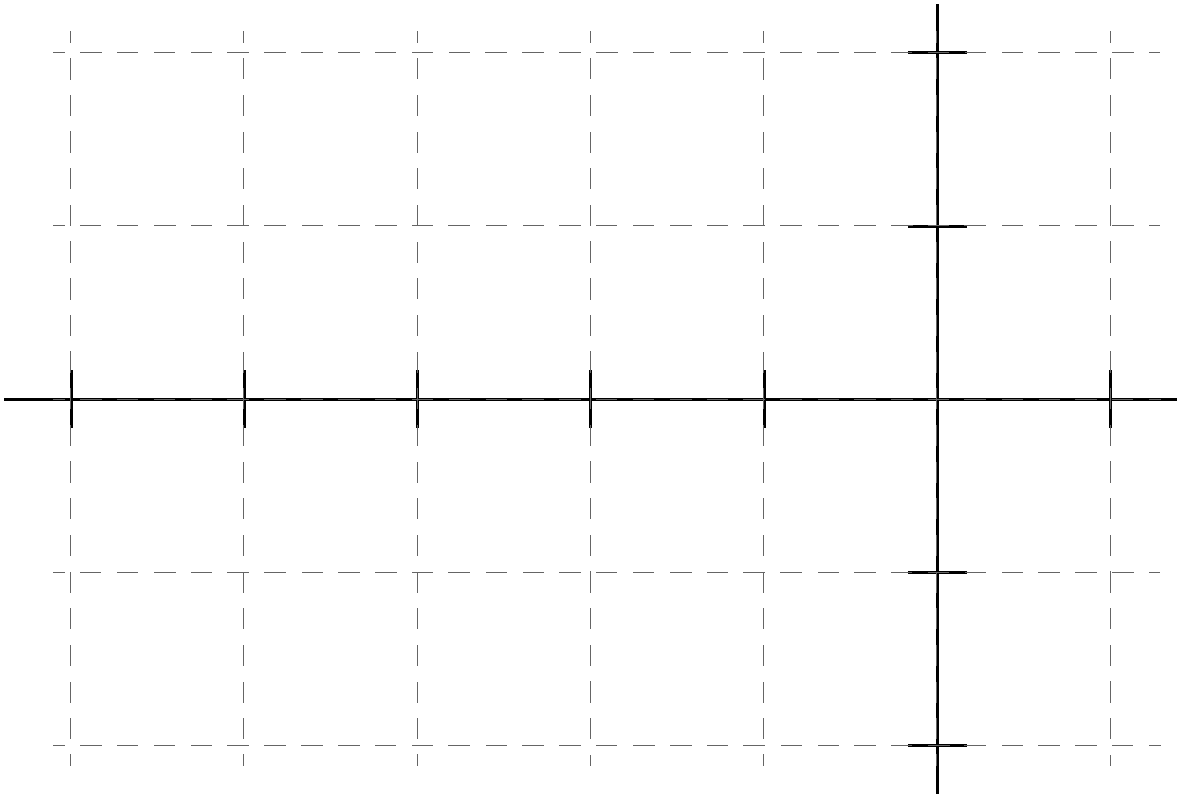
ANSWER for Parts 1 & 8





Worksheet for Part 5





Worksheet for Part 6