

# ECE 2210 Exam 3 given: Fall 16

1. (28 pts) Assume that diode  $D_1$  does **NOT** conduct.

Assume that diodes  $D_2$  and  $D_3$  **DO** conduct.

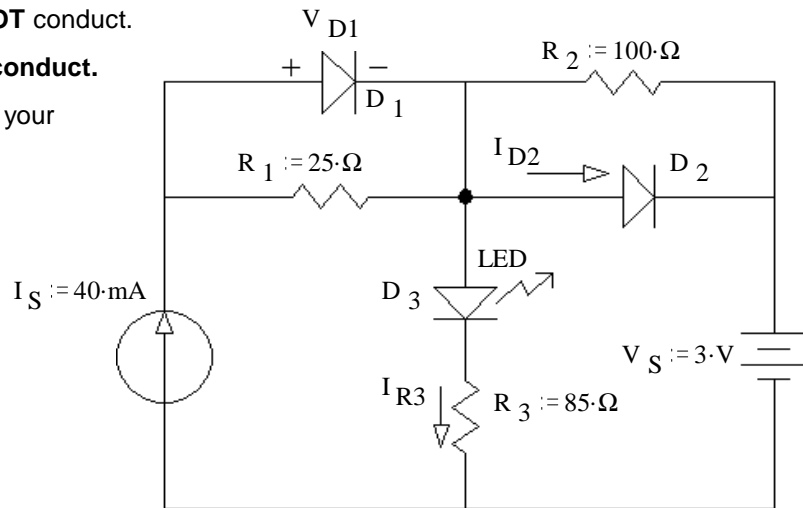
a) Stick with these assumptions even if your answers come out absurd.

Find the following:

$V_{D1} =$  \_\_\_\_\_

$I_{R3} =$  \_\_\_\_\_

$I_{D2} =$  \_\_\_\_\_



b) Based on the numbers above, was the assumption about  $D_1$  correct? Circle one:      yes      no  
 How do you know? (Specifically show a value which is or is not within a correct range.)

1. continued

c) Based on the numbers above, was the assumption about  $D_2$  correct? Circle one:    yes    no

How do you know? (Specifically show a value which is or is not within a correct range.)

d) Based on the numbers above, was the assumption about  $D_3$  correct? Circle one:    yes    no

How do you know? (Specifically show a value which is or is not within a correct range.)

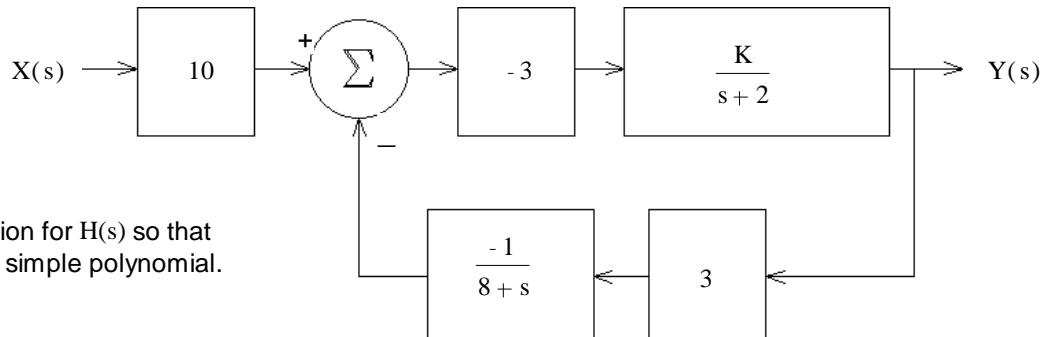
e) Based on your answers to parts b), c) & d), Circle one:    i) The **real**  $I_{R3} < I_{R3}$  calculated in part a.

ii) The **real**  $I_{R3} > I_{R3}$  calculated in part a.

iii) The **real**  $I_{R3} = I_{R3}$  calculated in part a.

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2. (14 pts) a) A feedback system is shown in the figure. What is the transfer function of the whole system, with feedback.



$$H(s) = \frac{Y(s)}{X(s)} = ?$$

Simplify your expression for  $H(s)$  so that the denominator is a simple polynomial.

3. (8 pts) A system has this transfer function: 
$$\mathbf{H}(s) = \frac{5 \cdot X \cdot s \cdot (s + 40)}{s^2 + 70 \cdot s + 1200 + 10 \cdot X}$$

a) Find the range of X to so that the transfer function will be over-damped.

Remember, I asked for a **RANGE** of X

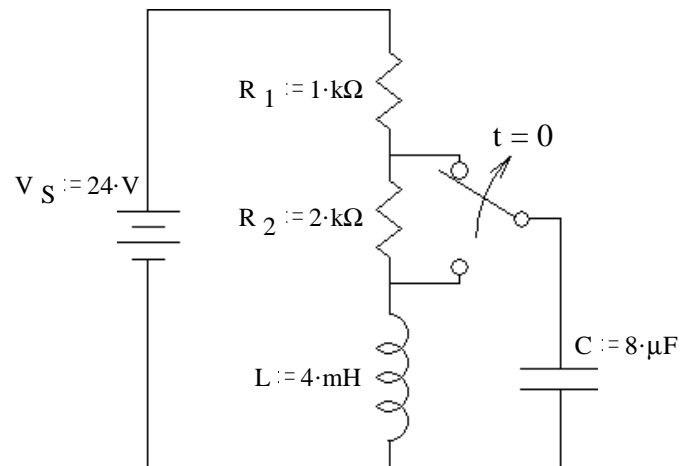
b) Does the transfer function have any zeros? Answer no or find the s value(s) of the zero(s).

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4. (28 pts) The switch has been down for a long time and is switched up (as shown) at time  $t = 0$ .

a) What are the final conditions of  $i_L$  and the  $v_C$ ?

$$i_L(\infty) = ? \quad v_C(\infty) = ?$$



b) Find the initial condition and initial slope of  $i_L$  that you would need to have in order to find all the constants in  $i_L(t)$ . Don't find  $i_L(t)$  or it's constants, just the initial conditions. More room on next page --->

c) Find the initial condition and initial slope of  $v_C$  that you would need to have in order to find all the constants in  $v_C(t)$ . Don't find  $v_C(t)$  or it's constants, just the initial conditions.

**Answers**

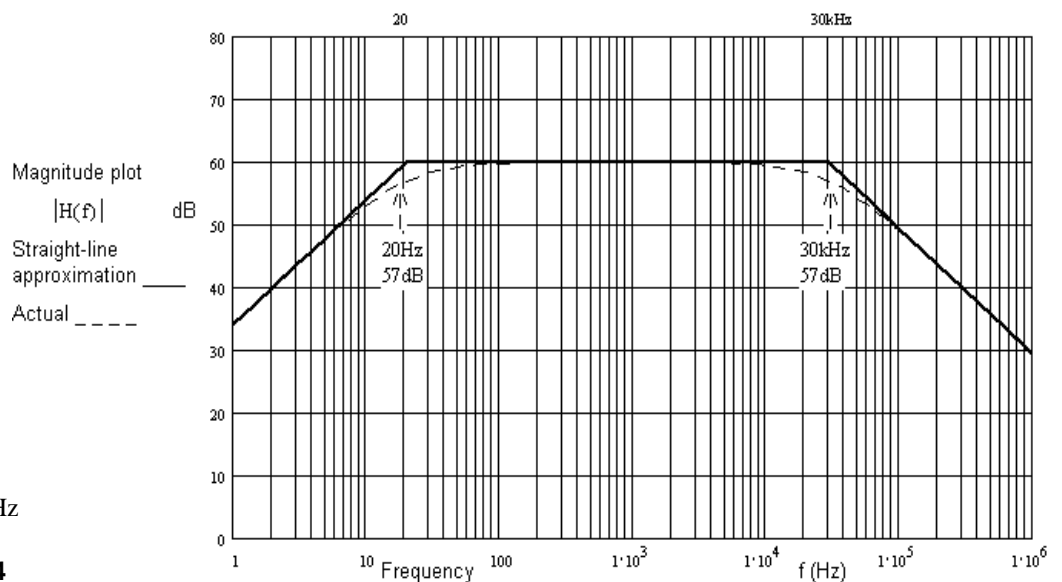
1. a) 1·V 20·mA 13·mA    b) no  $V_{D1} = 1·V > 0.7V$     c) yes  $I_{D3} = 13·mA > 0$     d) yes  $I_{D2} = 20·mA > 0$   
 e) iii)

2.  $\frac{-30 \cdot K \cdot (s + 8)}{s^2 + 10 \cdot s + 16 + 9 \cdot K}$

3. a)  $X < 2.5$   
 b) 0 & -40

4. a) 8·mA    16·V  
 b) 8·mA     $-4000 \cdot \frac{A}{sec}$   
 c) 0·V     $2000 \cdot \frac{V}{sec}$

5. a), b) at right  
 c) none    d) 20·Hz    30·kHz

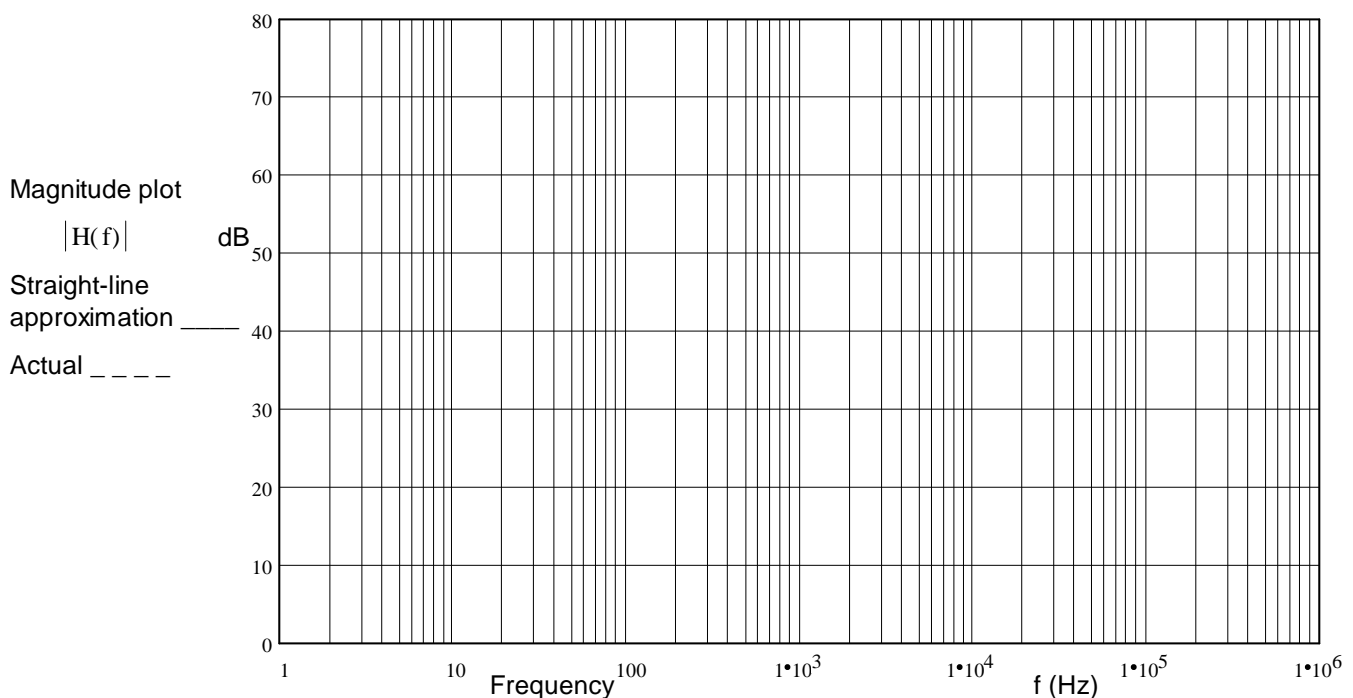


5. (22 pts) a) Draw the asymptotic Bode plot (the straight-line approximation) of the transfer function below.

Accurately draw it on the graph provided.

You must show and use the method from the class notes to get the Bode plot. That is, show things like the corner frequency(ies) , the approximations of the transfer function in each frequency region, calculations of dB, etc..

$$H(f) := \frac{3000 \cdot j \cdot f}{\left(\frac{j \cdot f}{10 \cdot \text{Hz}} + 2\right) \cdot \left(30 \cdot \text{Hz} + \frac{j \cdot f}{1000}\right)}$$



b) The asymptotic Bode plot is not exact. Using a dotted line, sketch the actual magnitude of the transfer function  $|H(f)|$  on the plot above. Indicate the point(s) where the difference between the two lines is the biggest (draw arrow(s)) and write down the actual magnitude(s) at that (those) point(s).