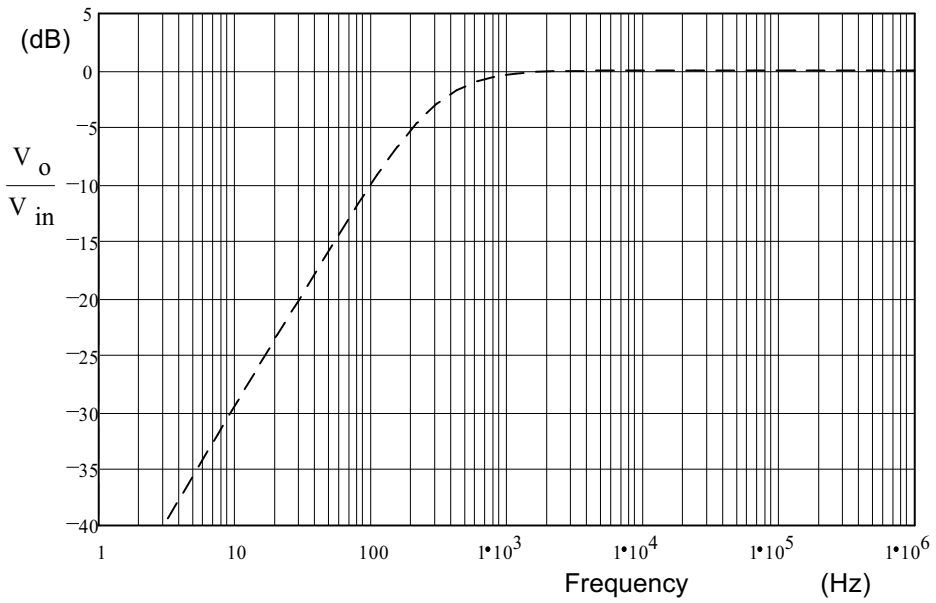
EE1050 Exam 3 given: Spring 02

(The space between problems has been removed.)

1. (19 pts) The frequency response curve of a circuit is shown below.

a) The circuit is what type of filter? Circle the best answer.

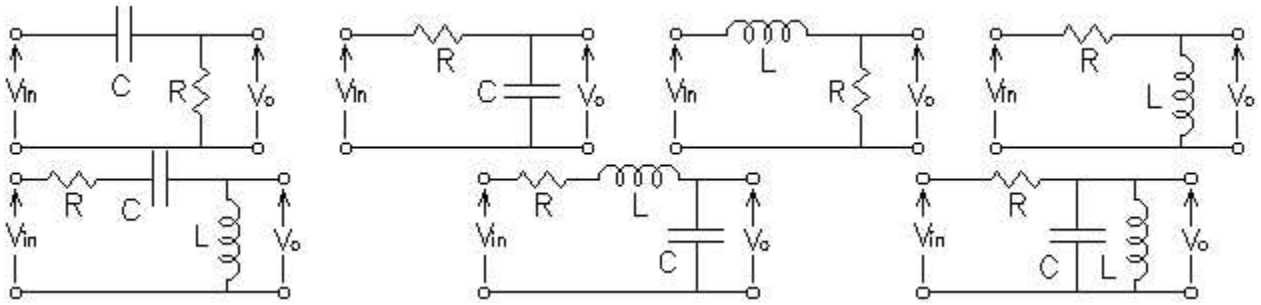
i) low pass
ii) high pass
iii) band pass
iv) band reject
v) sludge
vi) can't tell



b) Draw the asymptotic Bode plot of the filter (the straight-line approximation) right on the curve above.

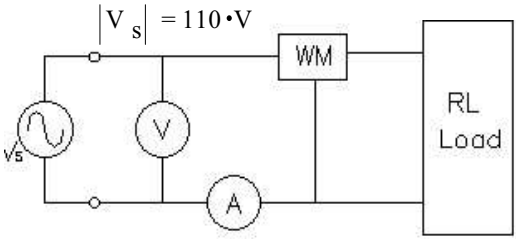
c) What is the corner or "break" frequency (f_c)?

d) Which of the circuits shown below could possibly be the circuit? (Circle the best two answers.).



e) In each of the circuits above, R = 130Ω. Find the values of all the other components in the two circuits that you circled.

2. (17 pts) For the 60 Hz load shown in the figure, the RMS voltmeter measures 110 V. The phasor diagram for the power is also shown. Find the following:



a) The complex power. **S** = ?

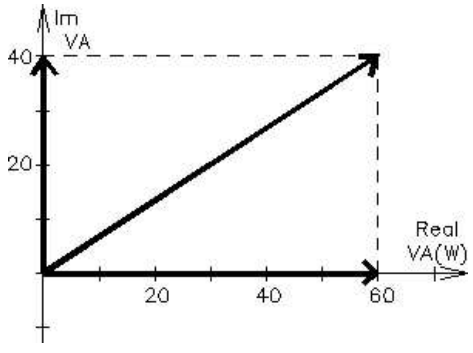
b) The apparent power. |S| = ?

c) The power factor. pf = ?

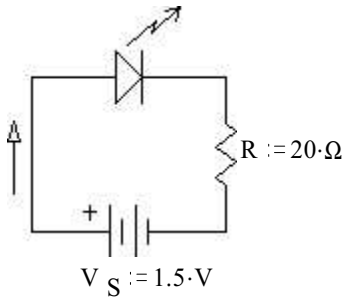
d) The item marked "WM" in the figure is a wattmeter, what does it read? (give a number)

e) The item marked "A" in the figure is an RMS ammeter, what does it read? (give a number)

f) The power factor is: i) leading ii) lagging (circle one)



3. Use constant-voltage-drop models for the diodes and LEDs on this page.
(4 pts) Find the current in the circuit shown

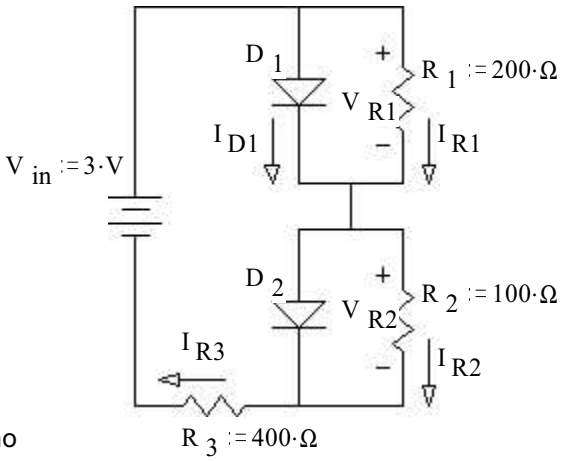


$V_S := 1.5 \cdot V$ $R := 20 \cdot \Omega$

LED needs 2V, it is not conducting $I = 0$

4. (23 pts) Assume that diode D_1 is conducting and that diode D_2 is not conducting.

a) Find V_{R1}, I_{R1}, I_{R3}, I_{D1}, V_{R2} based on these assumptions.
Do not recalculate if you find the assumptions are wrong.



V_{R1} = _____

I_{R1} = _____

I_{R3} = _____

I_{D1} = _____

V_{R2} = _____

b) 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.)

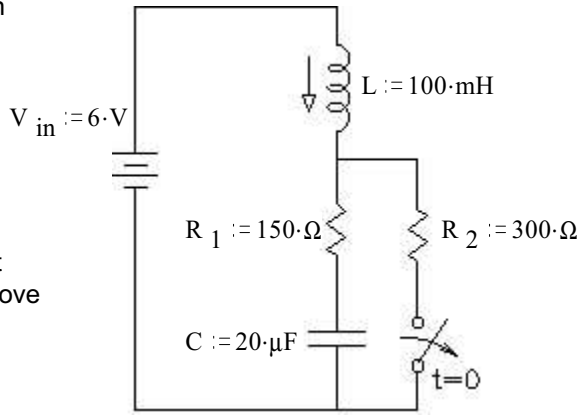
c) Was the assumption about D_2 correct? (circle one) yes no

How do you know?

5. (26 pts) Analysis of the circuit shown yields the characteristic equation and s values below.

The switch has been in the closed position for a long time and is opened (as shown) at time t = 0. Find the initial and final conditions and write the full expression for $i_L(t)$, including all the constants that you find. Don't let the odd position of the switch throw you, just use it to find your initial conditions.

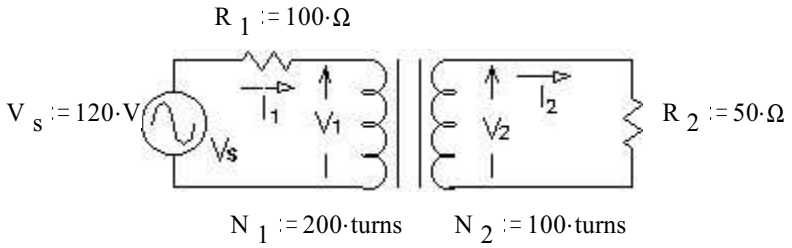
Clearly show important numbers (like initial and final conditions) to get partial credit. If you can't find some of these, guess so that you can move on and demonstrate what you do know.



$$0 = s^2 + \frac{R_1}{L}\cdot s + \frac{1}{L\cdot C} \qquad s_1 := -500\cdot\frac{1}{sec} \quad \text{and} \quad s_2 := -1000\cdot\frac{1}{sec}$$

6. (11 pts) The transformer shown in the circuit below is ideal. Find the following:
a) I_1 = ?

b) I_2 = ?



Answers

1. a) ii b) straight lines: 3Hz, -40dB to 300Hz, 0dB to 1MHz, 0dB c) 300Hz d) 1st and 4th e) 4.08µF 69mH

2. a) 60 + 40j VA b) 72.1VA c) 0.832 d) 60W e) 0.656A f) ii

3. 0 4.a) 0.7V 3.5mA 4.6mA 1.1mA 0.46V b) yes, $I_{D1} > 0$ yes, $V_{D2} < 0.7V$

5. $i_L(t) := 0 - 20\cdot mA\cdot e^{-500\,t} + 40\cdot mA\cdot e^{-1000\,t}$ 6. a) 0.4A b) 0.8A