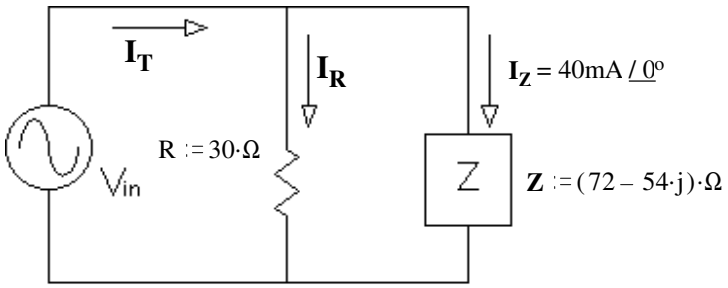
ECE2210/00 Exam 3 given: Fall 06

1. (18 pts)



a) Find $\mathbf{V_{in}}$ in polar form.

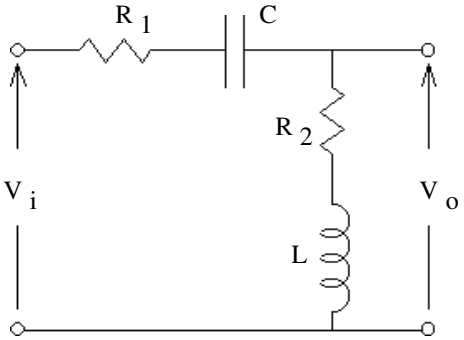
b) Find $\mathbf{I_T}$ in polar form..

c) Circle 1:

i) The source current leads the source voltage

ii) The source voltage leads the source current

2. (15 pts) a) Find the s-type transfer function of the circuit shown. V_i is the input and V_O is the output.
You MUST show work to get credit.



Simplify your expression for $H(s)$ so that the denominator is a simple polynomial beginning with s^2.

$\mathbf{H}(s) = ?$

b) Find the characteristic equation of the circuit shown.

c) The solutions to the characteristic equation are called the _____ of the transfer function.

d) Does the transfer function have one or more zeros? If yes, express it (them) in terms of R_1, R_2, C, & L.

3. (20 pts) Analysis of a circuit (not pictured) yields the characteristic equation below.

$0 = s^2 + 500\cdot s + 62500$ $\quad R := 80\cdot\Omega \quad L := 640\cdot\text{mH} \quad C := 25\cdot\mu\text{F} \quad V_{in} := 12\cdot\text{V}$

Further analysis yields the following initial and final conditions:

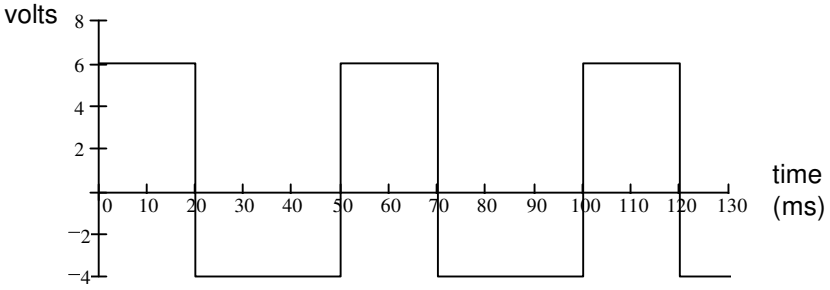
$i_L(0) = 50\cdot\text{mA}$ $\quad v_L(0) = -9\cdot\text{V}$ $\quad v_C(0) = 4\cdot\text{V}$ $\quad i_C(0) = 80\cdot\text{mA}$

$i_L(\infty) = 110\cdot\text{mA}$ $\quad v_L(\infty) = 0\cdot\text{V}$ $\quad v_C(\infty) = 12\cdot\text{V}$ $\quad i_C(\infty) = 0\cdot\text{mA}$

Write the full expression for $i_L(t)$, including all the constants that you find. $\quad i_L(t) = ?$

Include **units** in your answer

4. (10 pts) For waveform shown, find:



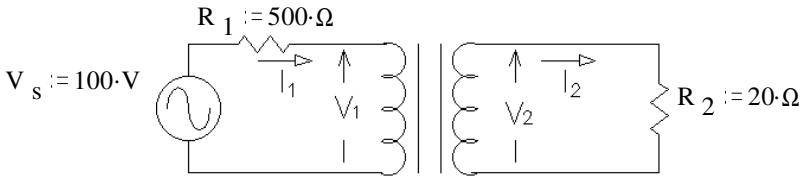
a) Average DC (V_{DC}) value

b) RMS (effective) value

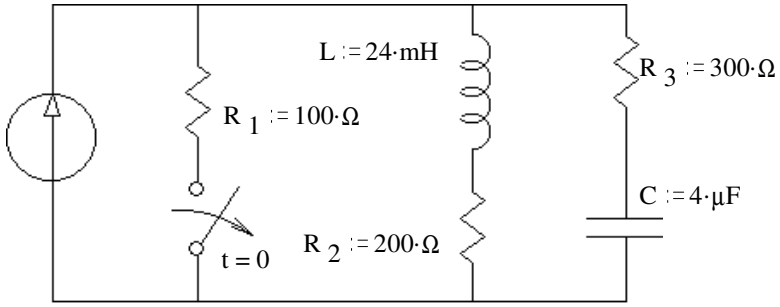
5. (13 pts) The transformer shown in the circuit below is ideal. It is rated at 120/12 V, 8 VA, 60 Hz
Find the following:

a) $I_1 = ?$

b) $V_2 = ?$



6. (24 pts) Consider the circuit at right. The switch has been in the closed position for a long time and is open (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 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.

c) 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.

Answers

1. a) $\mathbf{V_{in}} = 3.6\text{V} \angle -36.9^\circ$ b) $\mathbf{I_T} = 154\text{mA} \angle -27.9^\circ$ c) i) $-27.9^\circ > -36.9^\circ$

2. a) $\dfrac{s^2 + \dfrac{R_2}{L}\cdot s}{s^2 + \left(\dfrac{R_1 + R_2}{L}\right)\cdot s + \dfrac{1}{L\cdot C}}$ b) $0 = s^2 + \left(\dfrac{R_1 + R_2}{L}\right)\cdot s + \dfrac{1}{L\cdot C}$ c) poles d) 0 and $-\dfrac{R_2}{L}$

3. $i_L(t) := 110\cdot\text{mA} - 60\cdot\text{mA}\cdot e^{-\frac{250}{\text{sec}}\cdot t} - 29\cdot\dfrac{\text{A}}{\text{sec}}\cdot t\cdot e^{-\frac{250}{\text{sec}}\cdot t}$

4. a) $0\cdot\text{V}$ b) $4.9\cdot\text{V}$

5. a) $40\cdot\text{mA}$ b) $8\cdot\text{V}$

6. a) $300\cdot\text{mA}$ $60\cdot\text{V}$

b) $20\cdot\text{V}$ $50000\cdot\dfrac{\text{V}}{\text{sec}}$

c) $100\cdot\text{mA}$ $2500\cdot\dfrac{\text{A}}{\text{sec}}$

ECE 2210 Exam #3
Arn Stolp

Name _____
Scores:
Pgs 1&2 _____ of a possible 33 points

Pgs 3&4 _____ of a possible 30 points

Pgs 5&6 _____ of a possible 37 points

Total _____ of a possible 100 points