

RLC Circuit Exercises

The **due date** for this homework is **Sun 14 Apr 2013 8:00 PM EDT**.

Question 1

Checking units of expressions is an important way of achieving correct answers for impedances. The "secret" is to note that R , Ls and $\frac{1}{Cs}$ all have units of ohms (Ω).

What are the units of $RLCs^2$?

- ☐ siemens (Ω^{-1})
- ☐ ohms
- ☐ dimensionless

Question 2

Is this expression correct: $LCs^2 + R$?

- ☐ Yes
- ☐ No

Question 3

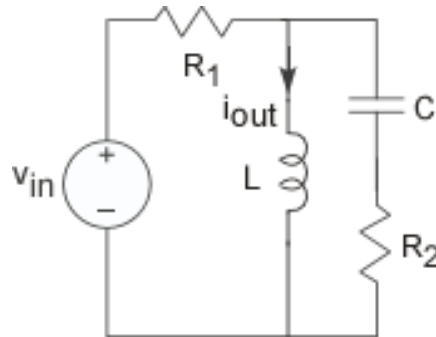
Can the following answer be correct?

$$Z = \frac{R_1 R_2 C s + R_3}{LC s^2 + RC s + 1}$$

- ☐ Yes
- ☐ No

Question 4

The following two questions concern this circuit.



What is the impedance of the circuit the voltage source "sees"?

Express your answer in terms of $s = j2\pi f$. Use R_1 , R_2 , L , C for the element values, R_1 , R_2 , L and C . For example, if

$$Z = \frac{R_1 L C s^2 + R_1 R_2 C s + 2 R_2}{L C s^2 + R_1 C s} \Bigg|_{s=j2\pi f} \quad \text{is your answer, type}$$

$(R_1 * L * C * s^2 + R_1 * R_2 * C * s + 2 * R_2) / (L * C * s^2 + R_1 * C * s)$. Because the expression is complicated, check units!

Preview

Question 5

Find the transfer function between the complex amplitude V_{in} of the source and the output current's complex amplitude I_{out} .

Express your answer in terms of $s = j2\pi f$. For example, if

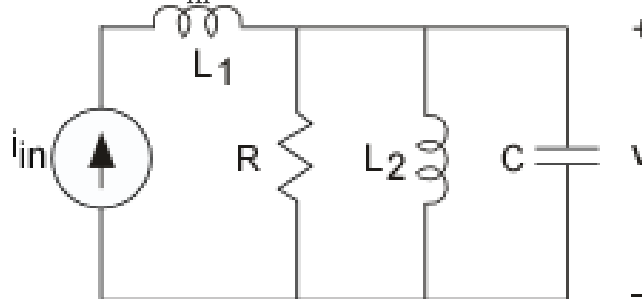
$$\frac{I_{out}}{V_{in}} = \frac{L C s^2 + R_1 C s}{R_1 L C s^2 + R_1 R_2 C s + 2 R_2} \Bigg|_{s=j2\pi f} \quad \text{is your answer, type}$$

$(L * C * s^2 + R_1 * C * s) / (R_1 * L * C * s^2 + R_1 * R_2 * C * s + 2 * R_2)$. Because the expression is complicated, check units!

Preview

Question 6

What is the transfer function $\frac{V}{I_{in}}$?

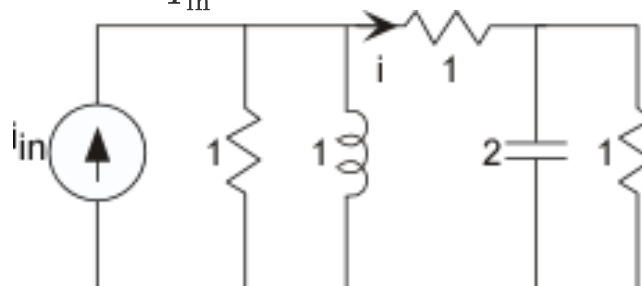


Express your answer in terms of $s = j2\pi f$. Represent the element values R , L_1 , L_2 and C by R , $L1$, $L2$ and C respectively.

Preview

Question 7

What is the transfer function $\frac{I}{I_{in}}$?

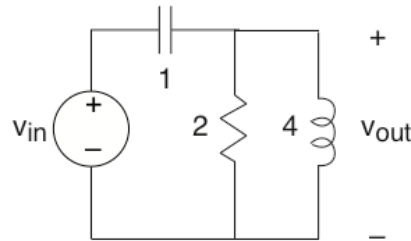


Express your answer in terms of $s = j2\pi f$.

Preview

Question 8

The following two questions concern this circuit.



Find the transfer function between the source and the indicated voltage.

Express your answer in terms of $s = j2\pi f$.

Preview

Question 9

When the source is $v_{in}(t) = 10 \sin\left(\frac{t}{2}\right)$, what is the output voltage $v(t)$?

Express your answer as a sinusoid: if $4 \sin(2\pi t + \pi/4)$ is your answer, enter it as $4*\sin(2*pi*t+pi/4)$.

Preview

☐ In accordance with the Honor Code, I certify that my answers here are my own work.

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