

task_c9fj1si7l797equs_with_calculation

Student Group

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Table of Contents

Exercise E4 Complex voltage dividers (written test, approx. 16 % of a 60-minute written test, SS2023)	2
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impedance, phasor, cutoff, exam ee1 SS2023

Exercise E4 Complex voltage dividers
(written test, approx. 16 % of a 60-minute written test, SS2023)

Task: Calculate the two impedances Z_1 and Z_2 in the circuit below resulting in the output impedance Z_L and a voltage U_O . Choose an appropriate scaling factor and write it down.

- $R = 1.1 \text{ k}\Omega$

Solution: $L = 3.5 \text{ mH}$

Result:

$$\underline{U}_I = 5 \text{ V}$$

$$\underline{Z}_1 = 50 \text{ k}\Omega$$

$$\underline{U}_O = 0.5 \text{ V} - j \cdot 1.5 \text{ V}$$

The cutoff frequency is the absolute value of the imaginary part of Z_L is equal to $\frac{1}{R} = \frac{1}{1.1 \text{ k}\Omega} \approx 909 \text{ rad/s}$. This leads to a cutoff frequency $f_c = \frac{1}{2\pi R} \approx 147 \text{ Hz}$. However, $R = 1.1 \text{ k}\Omega$ is not $1 \text{ k}\Omega$.
 $\frac{1}{R} = \frac{1}{1.1 \cdot 10^3 \text{ }\Omega} \approx 909 \text{ rad/s}$ \Rightarrow $f_c = \frac{1}{2\pi \cdot 1.1 \cdot 10^3} \approx 147 \text{ Hz}$

.. Calculate the impedance \underline{Z}_L .

Solution

$$\underline{Z}_L = j \omega L = j \cdot 2\pi \cdot 150 \text{ kHz} \cdot 3.5 \text{ mH}$$

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