

CASE WESTERN RESERVE UNIVERSITY
Case School of Engineering
Department of Electrical Engineering and Computer Science

ENGR 210. Introduction to Circuits and Instruments (4)

Quiz No. 12

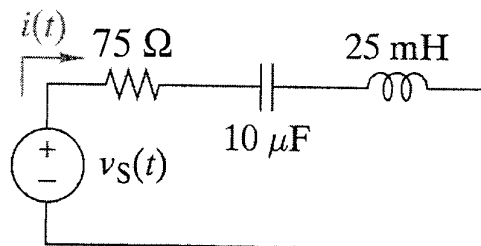
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Name (Section): Solutions.

PUT ANSWERS IN THE SPACE PROVIDED AND SHOW YOUR WORK

Problem 1 (10 points)

Find the impedance of each element in this circuit for operation in sinusoidal steady state at an angular frequency $\omega = 4000$ rad/sec, then find the total impedance of the circuit seen by $v_s(t)$ at this frequency. Finally, find the phasor current I given $V_s = 7.5 \angle 0^\circ$. Numerical values are required. Complete the table.



QUANTITY	VALUE
Resistor Impedance, Z_R	75Ω
Capacitor Impedance, Z_C	$-j 25 \Omega$
Inductor Impedance, Z_L	$j 100 \Omega$
Circuit Impedance, Z_{EQ}	$(75 + j 75) \Omega = 75\sqrt{2} \angle 45^\circ$
Phasor Current, I	$0.05 (1 - j) = 0.05\sqrt{2} \angle -45^\circ$

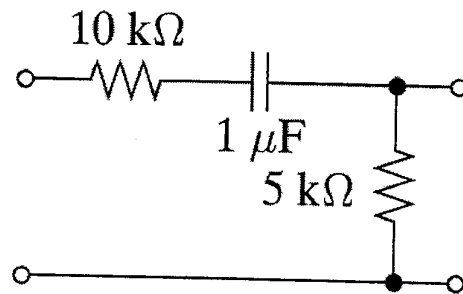
$\frac{V_s}{Z_{eq}}$
 \searrow
 $0.05\sqrt{2} \angle -45^\circ$

(over)

Problem 2 (10 points)

Consider this passive filter in which the input voltage is applied across the left-hand interface and the output voltage is taken from the right-hand interface. Determine the filter type (low-pass, high-pass, band-pass, or band-stop), its passband gain, and its cutoff frequency. *Numerical* answers are required. Complete the table.

Hint: a capacitor acts as an open circuit for dc and a short circuit for very high frequencies. The input interface is considered to be a short circuit when calculating the Thevenin resistance seen by the capacitor.



QUANTITY	VALUE
Filter type	<i>high-pass</i>
Cutoff frequency, ω_c	$\frac{1}{15} \times 10^3 \text{ rad/s}$
Passband gain	$\frac{1}{3}$

(over)