Solution

ECE101F19 Quiz 9, Dec. 3, 2019

Name_____ Student ID_____

We want to find the voltage between terminals a and b in time domain. But, since this quiz is only for 15 minutes, we will solve for the following sub-problems in parts 1 and 2.

*7.32 Find voltage $v_{ab}(t)$ in the circuit of Fig. P7.32, given that $i_s(t) = 35\sin(300t - 15°)$ mA, $R = 80\ \Omega$, $L = 15$ mH, and $C = 200\ \mu$F. ωt

$\omega = 300$

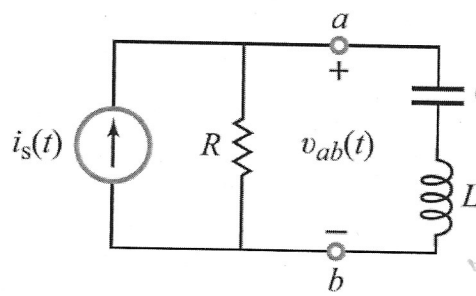

Figure P7.32: Circuit for Problem 7.32.

$\frac{1}{j\omega C} = -j\frac{1}{\omega C} = -j\frac{1}{300(200\times10^{-6})} = -j\frac{100}{6}$

$j\omega L = j(300)(15\times10^{-3}) = j4.5 = j\frac{27}{6}$

Part 1. (3 points) Find the phasor expression in polar form I_S for $i_S(t)$ with the correct magnitude unit. Recall that the reference function is cosine function in our phasor method.

$i_s(t) = 35\sin(300t - 15°) = 35\cos(300t - 15° - 90°) = 35\cos(300t - 105°)$

$I_s = 35e^{-j105°} = 35\angle{-105°}$

Part 2. (3 points) Find the total impedance between a nd b in polar form. You can just show the phase information in arctan form without finding the angle.

$Z_{ab} = 80 \parallel \left(-j\frac{100}{6} + j\frac{27}{6}\right) = 80 \parallel \left(-j\frac{73}{6}\right) = \frac{80\left(-j\frac{73}{6}\right)}{80 - j\frac{73}{6}} = \frac{-j5840}{480 - j73}$

$= \frac{5860e^{-j90°}}{\sqrt{480^2 + (-73)^2}\, e^{-j\tan^{-1}\left(\frac{73}{480}\right)}} = \frac{5860e^{-j90°}}{485.56e^{-j0.186°}}$

$= 12.07e^{-j88.14°}$

Part 3. (4 points) Find V_{ab} in phasor form in polar form.

$V_{ab} = Z_{ab}I_s = (12.07e^{-j88.14})(35e^{-j105°}) = 422.45e^{-j193.14°}$

$v_{ab}(t) = 422.45\cos(300t - 193.14°) = 422.45\sin(300t - 103.14°)$