ISRA UNIVERSITY
Islamabad Campus

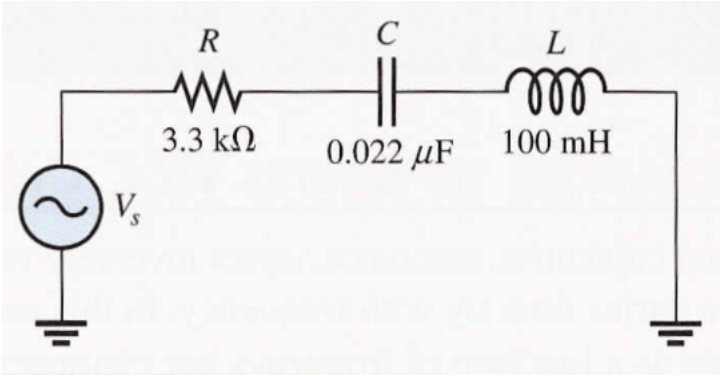
B.TECH (Electrical)
Semester – Spring 2018

ETCA-252 Circuit Analysis-2

Quiz – 3 Solution
Marks: 20 **Handout Date: 21/05/2018**

Question # 1:

For each of the following input frequencies, find the impedance in polar form for the circuit shown below.



1. $f = 2kHz$
2. $f = 5kHz$

Solution:

1. $f = 2kHz$

$$X_C = \frac{1}{2\pi(2\text{ kHz})(0.022\ \mu\text{F})} = 3.62\text{ k}\Omega$$

$$X_L = 2\pi(2\text{ kHz})(100\text{ mH}) = 1.26\text{ k}\Omega$$

The circuit is still capacitive, and the impedance is

$$\mathbf{Z} = \sqrt{(3.3\text{ k}\Omega)^2 + (1.26\text{ k}\Omega - 3.62\text{ k}\Omega)^2}\angle -\tan^{-1}\left(\frac{2.36\text{ k}\Omega}{3.3\text{ k}\Omega}\right)$$

$$= \mathbf{4.06\angle -35.6^\circ\ k\Omega}$$

2. $f = 5kHz$

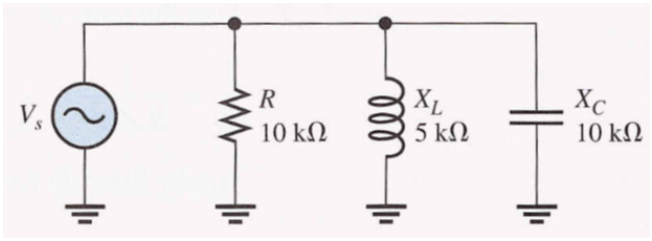
$$X_C = \frac{1}{2\pi(5\,\text{kHz})(0.022\,\mu\text{F})} = 1.45\,\text{k}\Omega$$
$$X_L = 2\pi(5\,\text{kHz})(100\,\text{mH}) = 3.14\,\text{k}\Omega$$

The circuit is now predominantly inductive. The impedance is

$$\mathbf{Z} = \sqrt{(3.3\,\text{k}\Omega)^2 + (3.14\,\text{k}\Omega - 1.45\,\text{k}\Omega)^2}\angle\tan^{-1}\left(\frac{1.69\,\text{k}\Omega}{3.3\,\text{k}\Omega}\right)$$
$$= \mathbf{3.71\angle 27.1°\,k\Omega}$$

Question # 2:

For the RLC circuit in figure below determine the conductance, capacitive susceptance, inductive susceptane and total admittance. Also determine the impedance.



Solution:

$$\mathbf{G} = \frac{1}{R\angle 0°} = \frac{1}{10\angle 0°\,\text{k}\Omega} = \mathbf{100\angle 0°\,\mu S}$$
$$\mathbf{B}_C = \frac{1}{X_C\angle -90°} = \frac{1}{10\angle -90°\,\text{k}\Omega} = \mathbf{100\angle 90°\,\mu S}$$
$$\mathbf{B}_L = \frac{1}{X_L\angle 90°} = \frac{1}{5\angle 90°\,\text{k}\Omega} = \mathbf{200\angle -90°\,\mu S}$$
$$\mathbf{Y}_{tot} = G + jB_C - jB_L = 100\,\mu\text{S} + j100\,\mu\text{S} - j200\,\mu\text{S}$$
$$= 100\,\mu\text{S} - j100\,\mu\text{S} = \mathbf{141.4\angle -45°\,\mu S}$$

From $\mathbf{Y}_{tot}$, you can determine $\mathbf{Z}_{tot}$.

$$\mathbf{Z}_{tot} = \frac{1}{\mathbf{Y}_{tot}} = \frac{1}{141.4\angle -45°\,\mu\text{S}} = \mathbf{7.07\angle 45°\,k\Omega}$$

Good Luck