ISRA UNIVERSITY
Islamabad Campus

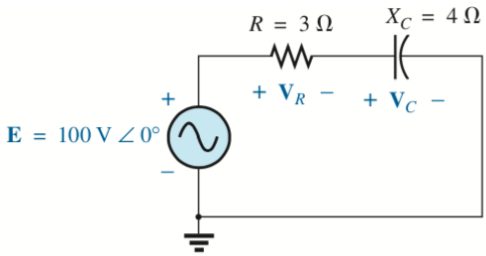
Program: BTECH (Electrical)
Semester – Spring 2018

ETCA-252 Circuit Analysis-II

Assignment – 3 Solution **Due Date: 21/05/2018**
Marks: 15 **Handout Date: 14/05/2018**

Question # 1:

Using the voltage divider rule, find the voltage across each element of the circuit:



Solution:

$$\mathbf{V}_C = \frac{\mathbf{Z}_C\mathbf{E}}{\mathbf{Z}_C + \mathbf{Z}_R} = \frac{(4\ \Omega\ \angle -90^\circ)(100\ \text{V}\ \angle 0^\circ)}{4\ \Omega\ \angle -90^\circ + 3\ \Omega\ \angle 0^\circ} = \frac{400\ \angle -90^\circ}{3 - j4}$$

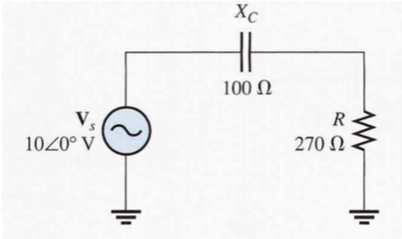
$$= \frac{400\ \angle -90^\circ}{5\ \angle -53.13^\circ} = \mathbf{80\ V\ \angle\ -36.87^\circ}$$

$$\mathbf{V}_R = \frac{\mathbf{Z}_R\mathbf{E}}{\mathbf{Z}_C + \mathbf{Z}_R} = \frac{(3\ \Omega\ \angle 0^\circ)(100\ \text{V}\ \angle 0^\circ)}{5\ \Omega\ \angle -53.13^\circ} = \frac{300\ \angle 0^\circ}{5\ \angle -53.13^\circ}$$

$$= \mathbf{60\ V\ \angle\ +53.13^\circ}$$

Question # 2:

Express the total impedance of the following circuit in both polar and rectangular form:



Solution:

The impedance in rectangular form is:

$$\boldsymbol{Z} = R - jX_C = 270\Omega - j100\Omega$$

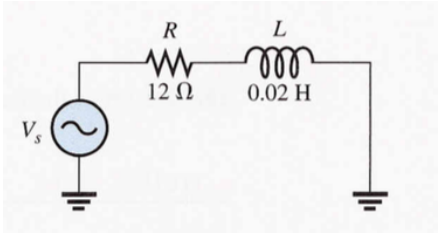
The impedance in polar form is:

$$\boldsymbol{Z} = \sqrt{R^2 + {X_C}^2}\angle - tan^{-1}\left(\frac{X_C}{R}\right)$$

$$= \sqrt{(270\Omega)^2 + (100\Omega)^2}\angle - tan^{-1}\left(\frac{100\Omega}{270\Omega}\right) = 287.9 \angle - 20.32°\Omega$$

Question # 3:

Determine the impedance at 1kHz, for the following circuit:



Solution:

The Inductance is as follows at 1kHz frequency:

$$X_L = 2\pi fL = 2\pi(1000Hz)(0.02H) \Rightarrow 125.66\Omega$$

The impedance in rectangular form is:

$$\boldsymbol{Z} = R + jX_L = 12\Omega - j125.66\Omega$$

The impedance in polar form is:

$$\boldsymbol{Z} = \sqrt{R^2 + {X_L}^2}\angle\, tan^{-1}\left(\frac{X_L}{R}\right)$$

$$= \sqrt{(12\Omega)^2 + (125.66\Omega)^2}\angle - tan^{-1}\left(\frac{125.66\Omega}{12\Omega}\right) = 127 \angle 84.5°\Omega$$

Good Luck