EEET-121 AC Circuits

Quiz #6 2185 Nodal and Superposition

Name (printed): ___________Solutions_________________

Program: _______________

All 6 questions are equally weighted, there is no partial credit. Circle the correct answer for each question.

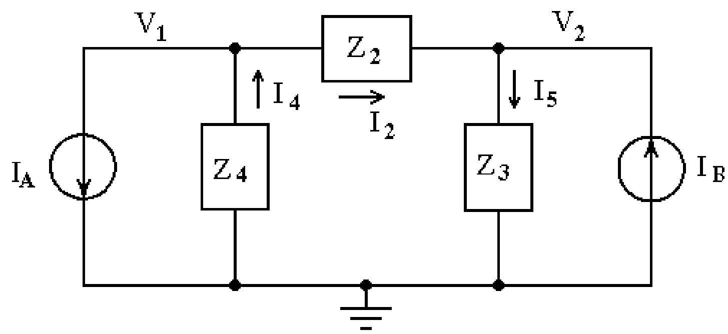

Figure 17.3

For the circuit shown above, answer the following questions:

1. When setting up this circuit for nodal analysis, which one equation describes the application of KCL at node 1?
   a. $I_2 = I_4 - I_5$ $I_A + I_2 - I_4 = 0$ -> $\mathbf{I_A + I_2 = I_4}$
   b. $I_A = I_4$
   c. $I_5 = I_A + I_4$
   d. $\mathbf{I_4 = I_A + I_2}$

2. Which one equation describes current I_2?
   a. $I_2 = -I_A$
   b. $I_2 = (V_1 + V_2)/Z_2$ Based on the direction of I_2 indicated, $\mathbf{I_2 = (V_1 - V_2)/Z_2}$
   c. $\mathbf{I_2 = (V_1 - V_2)/Z_2}$
   d. $I_2 = I_4 + I_A$

3. When setting up this circuit for nodal analysis, which one equation describes the application of KCL at node 2?
   a. $\mathbf{I_2 = I_5 - I_B}$ $-I_2 + I_5 - I_B = 0$ -> $\mathbf{I_2 = I_5 - I_B}$
   b. $I_A = I_4$
   c. $I_5 = I_A + I_4$
   d. $I_5 = I_2 - I_B$

Questions 4 through 6 on the back →

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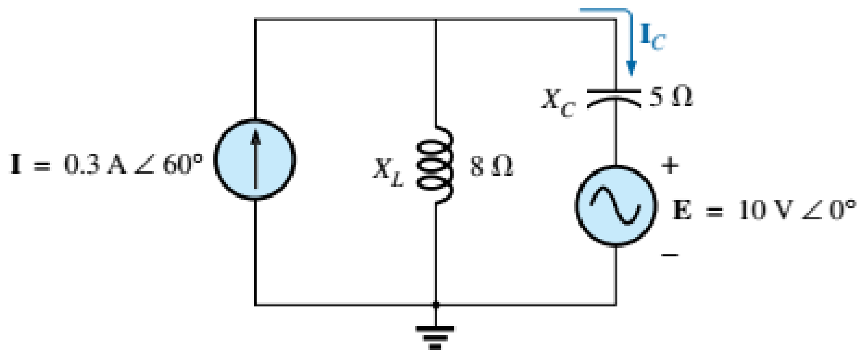


Note: **I** = 0.3ARMS < 60^{o}**,** **E** = 10VRMS < 0^{o}

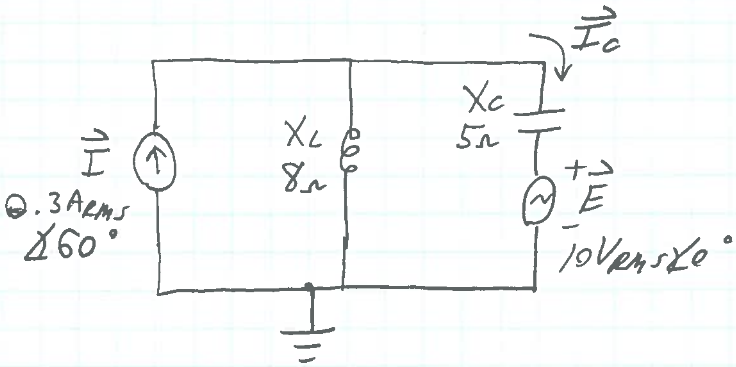
For the circuit shown above, answer the following questions:

4. Find **Ic**, the current flowing through the capacitor (in the direction indicated):
   a. 0.3ARMS < 60^{o}
   b. 1.26ARMS < - 92.7^{o}
   c. 3.31ARMS < 92.7^{o}
   d. **4.05ARMS < 84.3^{o}**

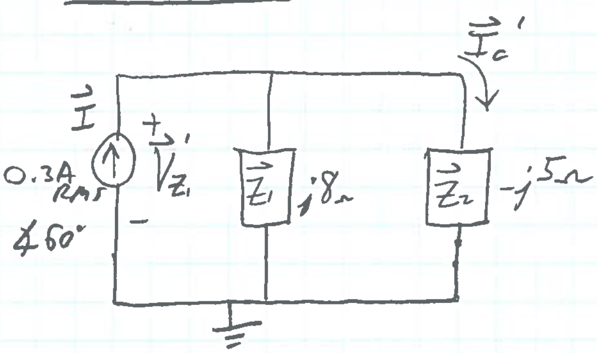
See attached for details (P4, P5 and P6)

5. Determine the voltage across source **I:**
   a. 26.9VRMS < -30^{o}
   b. **30.2VRMS < - 3.8^{o}**
   c. 4.3VRMS < 30^{o}
   d. 10VRMS < 180^{o}

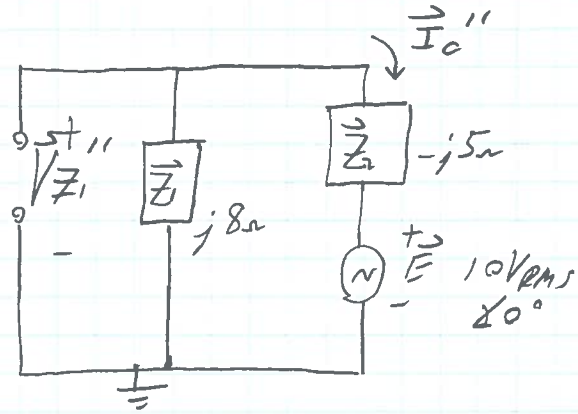
6. Find the voltage across the inductor due only to source **E**:
   a. 3.33VRMS < -56.6^{o}
   b. 4.00VRMS < - 30^{o}
   c. **26.7VRMS < 0^{o}**
   d. 32.1VRMS < 15.3^{o}



$\vec{I}$ ACTIVE



$\vec{E}$ ACTIVE



$$\vec{I}_C' = \vec{I} \cdot \frac{\vec{Z}_1 // \vec{Z}_2}{\vec{Z}_2}$$

$$= (0.3A_{RMS}\angle 60°)\left(\frac{-j13.\overline{33}\Omega}{-j5\Omega}\right)$$

$$\vec{I}_C' = \boxed{0.8A_{RMS}\angle 60°}$$

$$\vec{V}_{Z_1}' = \vec{I}_C' \cdot \vec{Z}_2$$

$$= (0.8A_{RMS}\angle 60°)(-j5\Omega)$$

$$= \boxed{4V_{RMS}\angle -30°}$$

$$\vec{I}_C'' = \frac{-\vec{E}}{\vec{Z}_1 + \vec{Z}_2} = \frac{-10V_{RMS}\angle 0°}{j8\Omega + (-j5\Omega)}$$

$$\vec{I}_C'' = \boxed{3.\overline{33}A_{RMS}\angle 90°}$$

$$\vec{V}_{Z_1}'' = (-\vec{I}_C'')(Z_1)$$

$$= (3.\overline{33}A_{RMS}\angle 90°)(j8\Omega)$$

$$\vec{V}_{Z_1}'' = \boxed{26.67V_{RMS}\angle 0°}$$ P#6

$$\vec{I}_C = \vec{I}_C' + \vec{I}_C'' = \boxed{4.05A_{RMS}\angle 84.3°}$$ P#4

$$\vec{V}_{Z_1} = \vec{V}_{Z_1}' + \vec{V}_{Z_1}'' = \boxed{30.2V_{RMS}\angle -3.8°}$$ P#5