PHYS 102: General Physics 2 KOÇ UNIVERSITY Spring Semester 2012

College of Sciences

Section 1 Quiz 13 17 May 2012

Closed book. No calculators are to be used for this quiz.
Quiz duration: 10 minutes

Name: **Student ID:** **Signature:**

A circuit is composed of a single loop with an alternating current source $V(t) = V_0 \sin(\omega t)$, a capacitor C and a resistor R. Derive the current I(t) as a function of (V_0, ω, t, C, R).

$$V(t) = V_0 \cos\left(\omega t - \frac{\pi}{2}\right)$$

$$I(t) = I_0 \cos(\omega t)$$

$$I_0 = \frac{V_0}{Z} = \frac{V_0}{\sqrt{R^2 + \frac{1}{\omega^2 C^2}}}$$

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Section 4 Quiz 13 17 May 2012

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Quiz duration: 10 minutes

Name: **Student ID:** **Signature:**

A circuit is composed of a single loop with an alternating current source $V(t) = V_0 \sin(\omega t)$, an inductor, a capacitor C and a resistor R. The resultant current is $I(t) = I_0 \sin(\omega t + \pi/4)$, and $X = \omega L = 1/4\,\omega C$.

(a) What is the resistance in terms of X?

(b) Completely determine the characteristic of this circuit element in terms of V_0, I_0, ω, t, X, L and C. (all of these will not be necessary).

$V(t) = V_0 \sin(\omega t)$,

$I = I_0 \sin(\omega t + \frac{\pi}{4})$, $X = \omega L = \frac{1}{4\omega C}$

$tg\,\phi = \frac{X_L - X_C}{R} \Rightarrow R = \frac{\frac{1}{4\omega C} - \frac{1}{\omega C}}{tg\,\phi}$

$= \frac{-\frac{3}{4\omega C}}{tg(-\frac{\pi}{4})} \Rightarrow R = \frac{3}{4\omega C}$

$Z = R\cos\phi \Rightarrow Z = \sqrt{2}R$

$V_L = I_0 X_L = \frac{I_0}{4\omega C}$,

$V_C = I_0 X_C = \frac{I_0}{\omega C}$

$V_R = I_0 R = \frac{3I_0}{4\omega C}$

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Section 3 Quiz 13 17 May 2012

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Quiz duration: 10 minutes

Name: **Student ID:** **Signature:**

A circuit is composed of a single loop with an alternating current source $V(t) = V_0 \cos(\omega t)$, and an unkown element. If the resultant current is $I(t) = \frac{V_0}{R} \cos(\omega t - \pi/2)$, identify the unkown element and plot the current passing through this element together with the potential difference.

$\frac{\pi}{2} = tg^{-1} \frac{X_L - X_C}{R} \Rightarrow$ $R = 0 \Rightarrow X_C = 0$

It contains just Inductor

$V_0 = I_0 X_L \Rightarrow I_0 = \frac{V_0}{\omega L}$

$I = \frac{V_0}{\omega L} \cos(\omega t - \frac{\pi}{2})$.

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Section 2 Quiz 13 17 May 2012

Closed book. No calculators are to be used for this quiz.
Quiz duration: 10 minutes

Name: **Student ID:** **Signature:**

A circuit is composed of a single loop with an alternating current source $V(t) = V_0 \sin(\omega t)$, an inductor L and a resistor R. Derive the power P(t) obtained from the alternating current source as a function of (V_0, ω, t, L, R).

$V = V_0 \sin(\omega t)$, $I = I_0 \sin(\omega t - \varphi)$

$$\tan\varphi = \frac{\omega L}{R}, \quad \varphi = \tan^{-1}\frac{\omega L}{R}$$

$$P(t) = I(t)\,V(t) = I_0 V_0 \sin(\omega t)\sin\left(\omega t - \tan^{-1}\frac{\omega L}{R}\right)$$

$$I_0 = \frac{V_0}{Z} = \frac{V_0}{\sqrt{R^2+\omega^2 L^2}}$$

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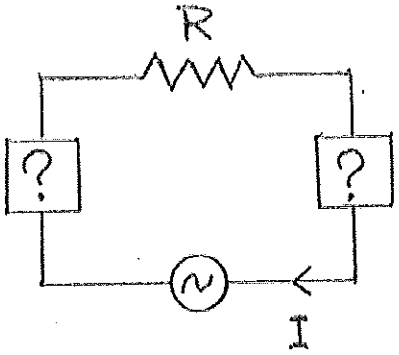
Section 5 Quiz 13 17 May 2012

Closed book. No calculators are to be used for this quiz.
Quiz duration: 10 minutes

Name: **Student ID:** **Signature:**

A circuit is composed of a single loop with an alternating current source $V(t) = V_0 \sin(\omega t)$, two unknown circuit elements and a resistor R.
The current is $I(t) = I_0 \sin(\omega t - \pi/3)$.



(a) What are the circuit elements in the boxes with the question marks?
(b) Determine I_0 in terms of (V_0, R, ω, t) (all of these may not be necessary).

Inductor capacitor

$V(t) = V_0 \sin(\omega t)$, $I(t) = I_0 \sin(\omega t - \frac{\pi}{3})$

$tg(\frac{\pi}{3}) = \frac{X_L - X_C}{R} \Rightarrow X_L - X_C = \sqrt{3} R$

$V_0 = I_0 Z \Rightarrow I_0 = \frac{V_0}{\sqrt{R^2 + (X_L - X_C)^2}} = \frac{V_0}{2R}$