生機系電工學第七次隨堂測驗 2011/04/27 解答

學號：　　姓名：

1.請問下列電壓 v(t)與電流 i(t)間的相量關係（Phase Relationship）

$v(t) = 8.6\sin(300t + 80°)$　　$i(t) = 0.12\sin(300t + 10°)$

■電壓 v(t)領先電流 i(t)相量角 70°　□電壓 v(t)落後電流 i(t)相量角 70°

□電流 i(t)領先電壓 v(t)相量角 70°　■電流 i(t)落後電壓 v(t)相量角 70°

2.What is the phase relationship between the following pairs of waveforms?

$v(t) = 12\sin(400t - 72°)$　$i(t) = 0.4\sin(400t - 16°)$

□ i(t) 領先 v(t) 88° □ v(t) 領先 i(t) 88° ■i(t) 領先 v(t) 56° □ v(t) 領先 i(t) 56°

□ i(t) 落後 v(t) 88° □ v(t) 落後 i(t) 88° □i(t) 落後 v(t) 56° ■ v(t) 落後 i(t) 56°

□以上皆非

3. What is the phase relationship between the following pairs of waveforms?

$v(t) = 0.05\sin(\omega t - 120°)$　$i(t) = 5\times10^{-6}\sin(\omega t + 20°)$

□ i(t) 領先 v(t) 100° □ v(t) 領先 i(t) 100° ■ i(t) 領先 v(t) 140° □ v(t) 領先 i(t) 140°

□ i(t) 落後 v(t) 100° □ v(t) 落後 i(t) 100° □ i(t) 落後 v(t) 140° ■ v(t) 落後 i(t) 140°

□以上皆非

4.當一電壓的 rms 值為 40V，頻率（Frequency）f 為 500Hz，相量角為+40°（領先），請問：

電壓的 peak value V_p 為 56.57 V

電壓的 angular velocity ω 為 **2π×500=3141.59** rad/s

電壓的 sinusoidal expression 為 **56.57sin(3141.59t+40°)**

5. Write the sinusoidal expression for a current i(t) that has a peak value of 6μA and leads the following voltage by 40°. $v(t) = 16\sin(1000t + 6°)$

答案： **i(t)=** $6\times10^{-6}\sin(1000t + 46°)$A

6. Write the sinusoidal expression for a voltage v(t) that has a peak value of 48mV and lags the following current by 60°. $i(t) = 4\times10^{-3}\sin(\omega t - 30°)$

答案： **v(t)=** $48\times10^{-3}\sin(\omega t - 90°)$V

7. Write the sinusoidal expression for the quantity using the information provided: I_{eff} = 36 mA, f = 1 kHz, phase angle = 60°

答案： i(t)= $\sqrt{2}\times36\times10^{-3}\sin(2\pi ft + 60°) = 50.9\times10^{-3}\sin(6{,}288.2t + 60°)$A

8. For the following pairs determine whether the element is a resistor, inductor, or capacitor, and determine the resistance, inductance, or capacitance.

$v(t) = 16\sin(200t + 80°)$V　$i(t) = 0.04\sin(200t - 10°)$A

□resistor　resistance=_____Ω

■inductor　inductance=**2**H

□capacitor　capacitance=_____F

電壓領先電流 90°，故為電感。$X_L = \omega L = \frac{V_m}{I_m} = \frac{16}{0.04} = 400\Omega$　　$L = \frac{X_L}{\omega} = \frac{400}{200} = 2H$

9. For the following pairs determine whether the element is a resistor, inductor, or capacitor, and determine the resistance, inductance, or capacitance.

$v(t) = 0.12\sin(1000t + 10°)V$　　$i(t) = 6\times10^{-3}\cos(1000t + 10°)A$

☐resistor　　resistance=_____Ω

☐inductor　　inductance=_____H

■capacitor　capacitance=_____**50μ**_____F

$i(t) = 6\times10^{-3}\cos(1000t + 10°)A = 6\times10^{-3}\sin(1000t + 100°)A$

電流領先電壓 90°，故為電容。$X_C = \frac{1}{\omega C} = \frac{V_m}{I_m} = \frac{0.12}{6\times10^{-3}} = 20\Omega$　　$C = \frac{1}{X_C\omega} = \frac{1}{20\times1000} = 50\mu F$

10. Using phasor notation, determine the voltage (in the time domain) across a 10 μF capacitor if the current through the capacitor is $i_C(t) = 40\times10^{-3}\sin(10t + 40°)$

$I_C(jw) = 28.284\times10^{-3}\angle40°$ A （current with phasor notation）

$V_C(jw) = 282.84\angle-50°$ V （voltage with phasor notation）

$v_C(t) = 400\sin(10t - 50°)$ V （voltage in time domain）

11. Using phasor notation, determine the current (in the time domain) through a 20-mH coil if the voltage across the coil is $v_L(t) = 4\sin(1000t + 10°)$

$V_L(jw) = 2.828\angle10°$ V （voltage with phasor notation）

$I_L(jw) = 0.1414\angle-80°$ A （current with phasor notation）

$i_L(t) = 0.2\sin(1000t - 80°)$ A （curremt in time domain）