Name: _____ Date: _____

___ **1.** A series *RL* circuit is connected to an emf source of angular frequency ω. The current:

A) leads the applied emf by $\tan^{-1}(\omega L/R)$ **D)** leads the applied emf by $\tan^{-1}(\omega R/L)$

B) lags the applied emf by $\tan^{-1}(\omega L/R)$ **E)** is zero

C) lags the applied emf by $\tan^{-1}(\omega R/L)$

___ **2.** A current of 10 A in a certain inductor results in a stored energy of 40 J. When the current is changed to 5 A in the opposite direction, the stored energy changes by:

A) 20 J **B)** 30 J **C)** 40 J **D)** 50 J **E)** 60 J

___ **3.** In a purely inductive circuit, the current lags the voltage by:

A) zero **D)** three-fourths of a cycle

B) one-fourth of a cycle **E)** one cycle

C) one-half of a cycle

___ **4.** An *LC* circuit has a capacitance of 30 μF and an inductance of 15 mH. At time $t = 0$ the charge on the capacitor is 10 μC and the current is 20 mA. The maximum charge on the capacitor is:

A) 8.9 μC **B)** 10 μC **C)** 12 μC **D)** 17 μC **E)** 24 μC

___ **5.** A resistor, an inductor, and a capacitor are connected in parallel to a sinusoidal source of emf. Which of the following is true?

A) The currents in all branches are in phase.

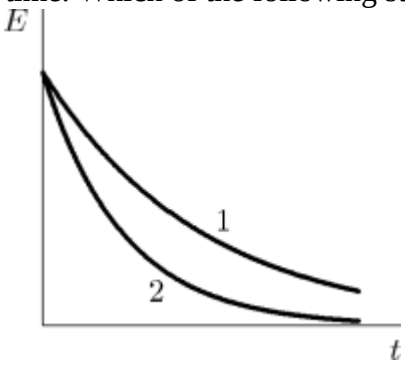
B) The potential differences across all branches are in phase.

C) The current in the capacitor branch leads the current in the inductor branch by one-fourth of a cycle

D) The potential difference across the capacitor branch leads the potential difference across the inductor branch by one-fourth of a cycle.

E) The current in the capacitor branch lags the current in the inductor branch by one-fourth of a cycle.

___ **6.** The graphs show the total electromagnetic energy in two RLC circuits as functions of time. Which of the following statements might be true?



A) Circuit 1 has a smaller resistance and a larger inductance
B) Circuit 1 has a larger resistance and a smaller inductance
C) Circuit 1 has the same resistance and a larger inductance
D) Circuit 1 has a larger resistance and a larger capacitance
E) Circuit 1 has the same resistance and a smaller capacitance

___ **7.** An *LC* circuit has an inductance of 20 mH and a capacitance of 5.0 μF. At time $t = 0$ the charge on the capacitor is 3.0 μC and the current is 7.0 mA. The total energy is:

A) 4.1×10^{-7} J
B) 4.9×10^{-7} J
C) 9.0×10^{-7} J
D) 1.4×10^{-6} J
E) 2.8×10^{-6} J

___ **8.** An *LC* circuit has an oscillation frequency of 10^5 Hz. If the capacitance is 0.1 μF, then the inductance must be about:

A) 10 mH **B)** 1 mH **C)** 25 μH **D)** 2.5 μH **E)** 1 pH

___ **9.** When the amplitude of the oscillator in a series *RLC* circuit is doubled:

A) the impedance is doubled
B) the voltage across the capacitor is halved
C) the capacitive reactance is halved
D) the power factor is doubled
E) the current amplitude is doubled

___ **10.** A charged capacitor and an inductor are connected in series. At time $t = 0$ the current is zero, but the capacitor is charged. If T is the period of the resulting oscillations, the next time after $t = 0$ that the energy stored in the magnetic field of the inductor is a maximum is:

A) T **B)** $T/4$ **C)** $T/2$ **D)** T **E)** $2T$

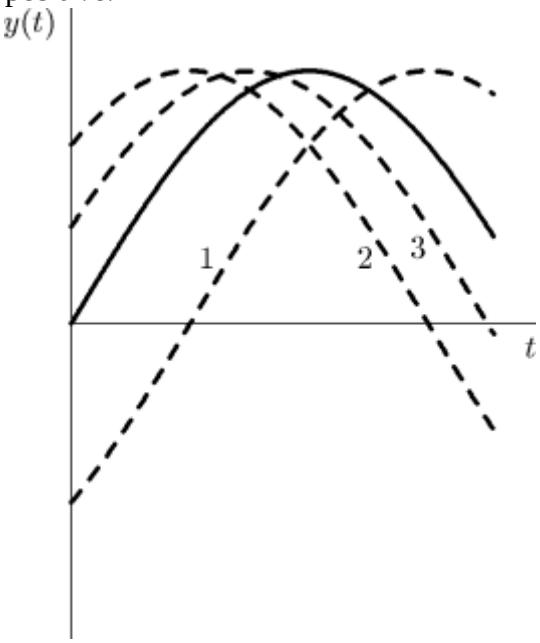
___ **11.** A charged capacitor and an inductor are connected in series. At time $t = 0$ the current is zero, but the capacitor is charged. If T is the period of the resulting oscillations, the next time after $t = 0$ that the energy stored in the electric field of the capacitor is a maximum is:
A) T **B)** $T/4$ **C)** $T/2$ **D)** T **E)** $2T$

___ **12.** An *RLC* series circuit has $L = 100$ mH and $C = 1\ \mu$F. It is connected to a 1000-Hz source and the source emf is found to lead the current by 75º. The value of R is:
A) 12.6 Ω **B)** 126 Ω **C)** 175 Ω **D)** 1750 Ω **E)** 1810 Ω

___ **13.** An inductance L and a resistance R are connected in series to an ideal battery. A switch in the circuit is closed at time 0, at which time the current is zero. The energy stored in the inductor is a maximum:
A) just after the switch is closed
B) at the time $t = L/R$ after the switch is closed
C) at the time $t = L/R$ after the switch is closed
D) at the time $t = 2L/R$ after the switch is closed
E) a long time after the switch is closed

___ **14.** An *RLC* circuit has an inductance of 25 mH and a capacitance of 5.0 μF. The charge on the capacitor does NOT oscillate but rather decays exponentially to zero. The resistance in the circuit must be:
A) greater than or equal to 20,000Ω
B) less than 20,000Ω but greater than 10,000Ω
C) less than 10,000Ω but greater than 5,000Ω
D) less than 5,000Ω but greater than 0
E) 0

___ **15.** In the diagram, the function $y(t) = y_m \sin(\omega t)$ is plotted as a solid curve. The other three curves have the form $y(t) = y_m \sin(\omega t + \phi)$, where ϕ is between $-\pi/2$ and $+\pi/2$. Rank the curves according to the value of ϕ, from the most negative to the most positive.



A) 1, 2, 3 **B)** 2, 3, 1 **C)** 3, 2, 1 **D)** 1, 3, 2 **E)** 2, 1, 3

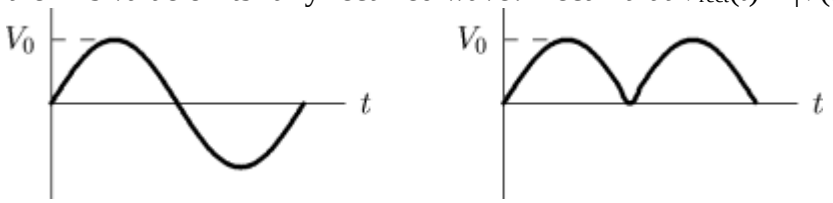
___ **16.** An ac generator producing 10 V (rms) at 200 rad/s is connected in series with a 50-Ω resistor, a 400-mH inductor, and a 200-μF capacitor. The rms voltage (in volts) across the inductor is:

A) 2.5 **B)** 3.4 **C)** 6.7 **D)** 10.0 **E)** 10.8

___ **17.** The rapid exponential decay in just a few cycles of the charge on the plates of capacitor in an *RLC* circuit might be due to:

A) a large inductance
B) a large capacitance
C) a small capacitance
D) a large resistance
E) a small resistance

___ **18.** The rms value of a sinusoidal voltage is $V_0/\sqrt{2}$, where V_0 is the amplitude. What is the rms value of its fully rectified wave? Recall that $V_{rect}(t) = |V(t)|$.



A) $V_0^2/\sqrt{2}$ **B)** $V_0^2/2$ **C)** $\sqrt{2}V_0$ **D)** $V_0/\sqrt{2}$ **E)** $V_0/(2\sqrt{2})$

___ **19.** An *RLC* circuit has a resistance of 200 Ω and an inductance of 15 mH. Its oscillation frequency is 7000 Hz. At time $t = 0$ the current is 25 mA and there is no charge on the capacitor. After five complete cycles the current is:

A) zero
B) 1.8×10^{-6} A
C) 2.1×10^{-4} A
D) 2.3×10^{-3} A
E) 2.5×10^{-2} A

___ **20.** In a sinusoidally driven series *RLC* circuit the current lags the applied emf. The rate at which energy is dissipated in the resistor can be increased by:

A) decreasing the capacitance and making no other changes
B) increasing the capacitance and making no other changes
C) increasing the inductance and making no other changes
D) increasing the driving frequency and making no other changes
E) decreasing the amplitude of the driving emf and making no other changes

Answer Key

1. B
Origin: Chapter 33- Electromagnetic Oscillations and Alternating Current, 49
2. B
Origin: Chapter 33- Electromagnetic Oscillations and Alternating Current, 5
3. B
Origin: Chapter 33- Electromagnetic Oscillations and Alternating Current, 48
4. D
Origin: Chapter 33- Electromagnetic Oscillations and Alternating Current, 34
5. B
Origin: Chapter 33- Electromagnetic Oscillations and Alternating Current, 71
6. A
Origin: Chapter 33- Electromagnetic Oscillations and Alternating Current, 37
7. D
Origin: Chapter 33- Electromagnetic Oscillations and Alternating Current, 33
8. C
Origin: Chapter 33- Electromagnetic Oscillations and Alternating Current, 18
9. E
Origin: Chapter 33- Electromagnetic Oscillations and Alternating Current, 61
10. B
Origin: Chapter 33- Electromagnetic Oscillations and Alternating Current, 12
11. C
Origin: Chapter 33- Electromagnetic Oscillations and Alternating Current, 13
12. B
Origin: Chapter 33- Electromagnetic Oscillations and Alternating Current, 65
13. E
Origin: Chapter 33- Electromagnetic Oscillations and Alternating Current, 2
14. A
Origin: Chapter 33- Electromagnetic Oscillations and Alternating Current, 39
15. D
Origin: Chapter 33- Electromagnetic Oscillations and Alternating Current, 64
16. E
Origin: Chapter 33- Electromagnetic Oscillations and Alternating Current, 78
17. D
Origin: Chapter 33- Electromagnetic Oscillations and Alternating Current, 41
18. D
Origin: Chapter 33- Electromagnetic Oscillations and Alternating Current, 73
19. C
Origin: Chapter 33- Electromagnetic Oscillations and Alternating Current, 38
20. A
Origin: Chapter 33- Electromagnetic Oscillations and Alternating Current, 68