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Continuing Education Course #538
AC Electrical 101+
Part I: Concepts & Single Phase

1. What is the phasor voltage $120 \text{ V} \angle 30^\circ$ as a function of time? The frequency is 60 Hz unless stated otherwise. The voltage is given as the "effective value" phasor notation.

- a. $v(t) = 170 \sin\left(60t + \frac{\pi}{6}\right)$
- b. $v(t) = 170 \sin\left(377t + \frac{\pi}{6}\right)$
- c. $v(t) = 170 \sin\left(377t + \frac{\pi}{3}\right)$
- d. $v(t) = 120 \sin\left(377t + \frac{\pi}{6}\right)$

2. What is $15 \angle -180^\circ$ in rectangular form?

- a. $0 - j15$
- b. $-1 + j0$
- c. $-15 + j0$
- d. $-15 + j15$

3. What approximately is $10 \angle 37^\circ$ in rectangular form?

- a. $8 + j6$
- b. $6 + j8$
- c. $6 + j6$
- d. $6 + j3$

4. What approximately is $50 \angle 120^\circ$ in rectangular form?

- a. $25 + j43$
- b. $-25 - j43$
- c. $-25 + j34$
- d. $-25 + j43$

5. What approximately is $21 \angle -\pi/2$ in rectangular form?

- a. $0 - j21$
- b. $21 - j0$
- c. $21 - j21$
- d. $21 + j21$

6. What is $6 + j7$ in phasor form?

- a. $9.22 \angle 40^\circ$
- b. $9.22 \angle 49.4^\circ$
- c. $49.4 \angle 9.22^\circ$
- d. $49.4 \angle 40^\circ$

7. What is $50 - j60$ in phasor form?

- a. $78.10\angle -40^\circ$
- b. $78.10\angle 40^\circ$
- c. $-78.10\angle 50.19^\circ$
- d. $78.10\angle -50.19^\circ$

8. What is $-75 + j45$ in phasor form?

- a. $87.46\angle 149.04^\circ$
- b. $87.46\angle -30^\circ$
- c. $149.04\angle 87.46^\circ$
- d. $149.04\angle -87.46^\circ$

9. What is $90 - j180$ in phasor form?

- a. $201.25\angle 63.43^\circ$
- b. $20.1\angle -63.43^\circ$
- c. $20.1\angle 63.43^\circ$
- d. $201.25\angle -63.43^\circ$

10. Which of the following is Euler's Identity?

- a. $\Sigma V = 0$
- b. $j = \sqrt{-1} = 1\angle \frac{\pi}{2}$
- c. $\cos^2\theta + \sin^2\theta = 1$
- d. $e^{j\theta} = \cos\theta + j\sin\theta$

11. Express the following in phasor form:

$$\frac{(7+j5)}{6}$$

- a. $1.4\angle 52.54^\circ$
- b. $1.4\angle 35.54^\circ$
- c. $8.4\angle 52.54^\circ$
- d. $8.4\angle 35.54^\circ$

12. Express the following in phasor form:

$$\frac{(13+j17)}{(15-j10)}$$

- a. $1.19\angle 18.90^\circ$
- b. $1.19\angle 86.28^\circ$
- c. $3.37\angle 18.90^\circ$
- d. $3.37\angle 86.28^\circ$

13. Express the following in phasor form:

$$\frac{0.034\angle 90^\circ}{0.034\angle 36^\circ}$$

- a. $0.59\angle 34^\circ$
- b. $0.59\angle -34^\circ$
- c. $32.3\angle 34^\circ$
- d. $34\angle 1^\circ$

14. A sinusoidal waveform has a peak at 1 ms and a period of 10 ms. What is the approximate angular frequency?

- a. 0.63 rad/s
- b. 6.30 rad/s
- c. 200 rad/s
- d. 630 rad/s

15. An 80 μF capacitor is in series with a 9 mH inductor.

What is the impedance of the capacitor?

- a. $0.03\Omega \angle -90^\circ$
- b. $0.03\Omega \angle 90^\circ$
- c. $33.16\Omega \angle -90^\circ$
- d. $33.16\Omega \angle 90^\circ$

16. An 80 μF capacitor is in series with a 9 mH inductor.

What is the impedance of the inductor?

- a. $3.39\Omega \angle 90^\circ$
- b. $3.39\Omega \angle -90^\circ$
- c. $540\Omega \angle 90^\circ$
- d. $3400\Omega \angle 90^\circ$

17. An 80 μF capacitor is in series with a 9 mH inductor.

What is the impedance angle? Is the circuit leading or lagging?

- a. $\angle -90^\circ$ leading
- b. $\angle +90^\circ$ leading
- c. $\angle -90^\circ$ lagging
- d. $\angle +90^\circ$ lagging

18. What is the average value of a sinusoid? What is average value of a rectified sinusoid?

- a. 0 ; $\frac{2V_m}{\pi}$
- b. $2\pi V_{\text{max}}$; $\frac{2V_m}{\pi}$
- c. $\frac{2V_m}{\pi}$; $2V_{\text{max}}$
- d. $\frac{V_m}{\pi}$; 0

19. What is the rms value of a sawtooth waveform? What is the associated Crest Factor?

- a. $\frac{V_m}{\sqrt{2}}$; $\frac{1}{\sqrt{2}}$
- b. $\frac{V_m}{\sqrt{2}}$; $\sqrt{2}$
- c. $\frac{V_m}{\sqrt{3}}$; $\frac{1}{\sqrt{3}}$
- d. $\frac{V_m}{\sqrt{3}}$; $\sqrt{3}$

20. What is the rms value of a 12 V signal?

- a. 1.2 V
- b. 6 V
- c. 7.6 V
- d. 12 V

21. Capacitor oppose the rate of change of _____ in a circuit.

- a. current
- b. power
- c. resistance
- d. voltage

22. Inductors oppose the rate of change of _____ in a circuit.

- a. current
- b. power
- c. resistance
- d. voltage

23. In a leading circuit, the impedance angle is _____ and the current leads by _____ degrees.

- a. negative ; 90°
- b. negative; -180°
- c. positive; -90°
- d. positive; $+180^\circ$

24. In a lagging circuit, the impedance angle is _____ and the current leads by _____ degrees.

- a. negative ; 90°
- b. negative; -180°
- c. positive; $+90^\circ$
- d. positive; -180°

25. Four inductors are in series with values of 3 mH, 4 mH, 5 mH, and 6 mH.

What is the total inductance of the circuit?

- a. 0.95 mH
- b. 7 mH
- c. 11 mH
- d. 18 mH

26. Two capacitors are in series with values of 3 μF and 4 μF .

What is the total capacitance of the circuit?

- a. 1.7 μF
- b. 3.7 μF
- c. 4.7 μF
- d. 12 μF

27. The power factor is the relationship between current and voltage. However, it is equivalent to describing the power factor as the _____ power divided by the _____ power.

- a. real / reactive
- b. reactive / real
- c. apparent / real
- d. real / apparent

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