1. In a series *RLC* circuit that is operating above the resonant frequency, the current.

$f > f_0 \Rightarrow u_g$ leads i. Then i lags u_g

Correct answer is A

(A) Lags the applied voltage
(B) Leads the applied voltage
(C) Is in phase with the applied voltage
(D) Is zero

2. The impedance at the resonant frequency of a series *RLC* circuit with *L* = 20 mH, *C* = 0.02 μF, and *R* = 90 Ω is

(A) 0 Ω
(B) 90 Ω
(C) 20 Ω
(D) 40 Ω

$$At\ reasonance: x_L = x_C$$

$$\text{Im}\,pedance: Z = \sqrt{R^2 + (x_L - x_C)^2}$$

$$\Rightarrow Z = \sqrt{R^2 + (x_L - x_C)^2} = R = 90\Omega$$

Correct answer is B

3. **A 24 Ω resistor, an inductor with a reactance of 120 Ω, and a capacitor with a reactance of 120 Ω are in series across a 60 V source. The circuit is at resonance. The voltage across the inductor is**

(A) 60 V
(B) 660 V
(C) 30 V
(D) 300 V

$$At\ reasonance: x_L = x_C \quad \text{Im}\,pedance: Z = \sqrt{R^2 + (x_L - x_C)^2}$$

$$\Rightarrow Z = \sqrt{R^2 + (x_L - x_C)^2} \Rightarrow Z = R = 24\Omega$$

$$V_G = ZI \Rightarrow I = \frac{60}{24} = 2.5A \qquad But\ \ V_L = x_L I = 120 \times 2.5 = 300V$$

Correct answer is D

4. The applied voltage for a series RLC circuit when I_T = 3 mA, V_L = 30 V, V_C = 18 V, and R = 1000 ohms is:

A. 3.00 V
B. 12.37 V
C. 34.98 V
D. 48.00 V

$$V_G = ZI, but\ \ Z = \sqrt{R^2 + (x_L - x_C)^2} \quad But\ \ V_L = x_L I \Rightarrow x_L = \frac{30}{3\times10^{-3}} = 10^4\Omega$$

$$And\ \ V_C = x_C I \Rightarrow x_C = \frac{18}{3\times10^{-3}} = 6000\Omega \quad V_G = ZI = 4123.1\times3\times10^{-3} = 12.37V$$

$$Z = \sqrt{1000^2 + (10000 - 6000)^2} = 4123.1\Omega$$

Correct answer is B

5. An inductance of 10 mH connected across a 100 V, 50 Hz supply has an inductive reactance of:

A. $10\pi\ \Omega$

B. $100\pi\ \Omega$

C. $\pi\ \Omega$

D. π H

$$x_L = 2\pi fL = 2\pi \times 50 \times 0.01 = \pi\Omega$$

Correct answer is C

6. When the frequency of an a.c. circuit containing resistance and inductance is increased, the current:

A. decreases

B. increases

C. stays the same

$$\text{Im}\,pedance: Z = \sqrt{R^2 + x_L^2} \quad but\ \ x_L = 2\pi fL,\ when\ \ f \nearrow \Rightarrow x_L \nearrow$$

$$but\ \ Z = \sqrt{R^2 + x_L^2} \Rightarrow Z \nearrow,\ but\ \ I = \frac{V_g}{Z} \Rightarrow I \searrow$$

Correct answer is A

7. When the frequency of an a.c. circuit containing resistance and capacitance is decreased, the current

A. decreases

B. increases

C. stays the same

$$\text{Impedance}: Z=\sqrt{R^2+x_C^2} \quad but \quad x_C=\frac{1}{2\pi fC}, \; when \; f \searrow \Rightarrow x_C \nearrow$$

$$but \; Z=\sqrt{R^2+x_C^2} \Rightarrow Z \nearrow, \; but \; I=\frac{V_g}{Z} \Rightarrow I \searrow$$

Correct answer is A

8. A capacitor of 1 μF is connected to a 50 Hz supply. The capacitive reactance is:

A. 50 MΩ

B. $\frac{10}{\pi}$kΩ

C. $\frac{\pi}{10^4}$Ω

D. $\frac{10}{\pi}$Ω

$$x_C=\frac{1}{2\pi fC}=\frac{1}{2\pi\times 50\times 10^{-6}}=\frac{10^4}{\pi}\Omega=\frac{10}{\pi}k\Omega$$

Correct answer is B

9. In a series a.c. circuit the voltage across a pure inductance is 12 V and the voltage across a pure resistance is 5 V. The supply voltage is:

A. 13 V

B. 17 V

C. 7 V

D. 2.4 V

$$V_G = ZI, but\ Z = \sqrt{R^2 + x_L^2}$$

$$But\ V_L = x_L I \Rightarrow x_L = \frac{V_L}{I}\ and\ V_R = RI \Rightarrow R = \frac{V_R}{I}$$

$$Z = \sqrt{(\frac{V_R}{I})^2 + (\frac{V_L}{I})} = \frac{1}{I}\sqrt{V_R^2 + V_L^2}$$

$$V_G = \sqrt{V_R^2 + V_L^2} = \sqrt{25+144} = 13V$$

Correct answer is A

10. In an a.c. circuit V and I are given by V = 50 sin50t volt and I = 100 sin(50t + π/3) mA. The power dissipated in the circuit

(A) 2.5 kW
(B) 1.25 W
(C) 5.0 kW
(D) 500 watt

$$Power: P = U.I\cos\varphi$$

$$U_m = 50V, \; but \; U = \frac{U_m}{\sqrt{2}} = \frac{50}{\sqrt{2}}V \quad I_m = 100mA = 0.1A, \; but \; I = \frac{I_m}{\sqrt{2}} = \frac{0.1}{\sqrt{2}}A$$

$$\varphi = -\frac{\pi}{3}rd \qquad \Rightarrow P = \frac{50}{\sqrt{2}} \times \frac{0.1}{\sqrt{2}}\cos(-\frac{\pi}{3}) = 1.25W$$

Correct answer is B

11. The average power dissipation in pure inductance in ac circuit, is

(A) $1/2Li^2$
(B) $2Li^2$
(C) $Li^2/4$
(D) zero.

$$Pure \; inductance: \varphi = \frac{\pi}{2} \Rightarrow P = U.I\cos\varphi = 0$$

Correct answer is D

12. In a series L, R, C, circuit which is connected to a.c. source. When resonance is obtained then net impedance Z will be

(A) Z = R
(B) Z = ωL -1/ωC
(C) Z = ωL
(D) Z = 1/ωC

$$At\ reasonance : Z = R$$

Correct answer is A

13. An L,C, R series circuit is connected to a.c. source. At resonance, the applied voltage and the current flowing through the circuit will have a phase difference of

(A) π/4
(B) zero.
(C) π
(D) π/2

$$At\ reasonance : u_g\ and\ i\ are\ in\ phase : \varphi = 0$$

Correct answer is B

14. A coil of resistance 2000Ω and self-inductance 1.0 Henry has been connected to an a.c. source of frequency 2000/2π Hz. The phase difference between voltage and current is

(A) 30°
(B) 60°
(C) 45°
(D) 75°

$$\cos\varphi = \frac{r}{Z}\ and\ Z = \sqrt{r^2 + (2\pi fL)^2} = \sqrt{2000^2 + (2\pi \times \frac{2000}{2\pi} \times 1)^2} = 2000\sqrt{2}\Omega$$

$$\cos\varphi = \frac{2000}{2000\sqrt{2}} = \frac{1}{\sqrt{2}} \Rightarrow \varphi = 45^0$$

Correct answer is C

15. In a series resonant circuit, the a.c. voltage across resistance R, inductance L and capacitance C are 5V, 10V and 10V, respectively. The a.c. voltage applied to the circuit will be

16. (A) 20V

17. (B) 10V

18. (C) 5V

19. (D) 25V

$$V_G = \sqrt{V_R^2 + (V_L - V_C)^2} = \sqrt{25 + (10-10)^2} = 5V$$

Correct answer is C

16. A resistance R Ω is connected in series with capacitance C Farad value of impedance of the circuit is 10 Ω and R = 6Ω so, find the power factor of circuit.

(A) 0.4

(B) 0.6

(C) 0.67

(D) 0.9

$$\cos\varphi = \frac{R}{Z} = \frac{6}{10} = 0.6$$

Correct answer is B

17. In a R, L, C circuit, three elements is connected in series by an a.c. source. If frequency is less than resonating frequency then net impedance of the circuit will be

(A) capacitive

(B) inductive

(C) capacitive or inductive.

(D) pure resistive.

$F<f_0 \Rightarrow$ i leads u_g then the circuit is capacitive.

Correct answer is A

18. Using an A.C. voltmeter, the potential difference in the electrical line in a house is read to be 234 volts. If the line frequency is known to be 50 cycles per second, the equation for the line voltage is

(A) V = 165 sin(100πt)
(B) V = 331 sin(100πt)
(C) V = 234 sin(100πt)
(D) V = 440 sin(100πt)

$$v = V_m \sin(wt),\ but\ V_m = V\sqrt{2} = 234\sqrt{2} = 331V\ \ and\ \ w = 2\pi f = 100\pi rd/s$$

$$v = 331\sin(100\pi t)$$

Correct answer is B

19. An alternating voltage E (in volts) = 200√2 sin (100t) is connected to a 1 μF capacitor through an a.c. ammeter. The reading of the ammeter shall be

(A) 10mA
(B) 20mA
(C) 40mA
(D) 80mA

$$And\ \ V_C = x_C I \Rightarrow I = \frac{V_C}{x_C},\ but\ V_C = \frac{V_m}{\sqrt{2}} = \frac{200\sqrt{2}}{\sqrt{2}} = 200V$$

$$but\ \ x_C = \frac{1}{wC} \Rightarrow x_C = \frac{1}{100\times 10^{-6}} = 10^4\Omega$$

$$\Rightarrow I = \frac{V_C}{x_C} = \frac{200}{10000} = 0.02A = 20mA$$

Correct answer is B

20. In a series R, L, C circuit $X_L = 10\Omega$, $X_C = 4\Omega$ and $R = 6\Omega$. Find the power factor of the circuit.

(A) $1/\sqrt{2}$

(B) $\sqrt{3}/2$

(C) $1/2$

(D) none of the these.

$$\cos\varphi = \frac{R}{Z} \quad and \quad Z = \sqrt{R^2 + (x_L - x_C)^2} \Rightarrow Z = \sqrt{36 + (10-4)^2} = 6\sqrt{2}\Omega$$

$$\cos\varphi = \frac{R}{Z} = \frac{6}{6\sqrt{2}} = \frac{1}{\sqrt{2}}$$

Correct answer is A