21 ALTERNATING CURRENT

MCQs with One Correct Answer

1. The current I passed in any instrument in alternating current circuit is I = 2 sin ωt amp and potential difference applied is given by V = 5 cos ωt volt then power loss over a complete cycle is in instrument is

(a) 2.5 watt (b) 5 watt

(c) 10 watt (d) zero

2. An alternating e.m.f. of angular frequency ω is applied across an inductance. The instantaneous power developed in the circuit has an angular frequency [take phase difference between emf and current is $\frac{\pi}{2}$]

(a) $\frac{\omega}{4}$ (b) $\frac{\omega}{2}$

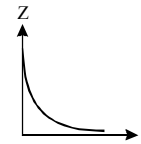
(c) ω (d) 2ω

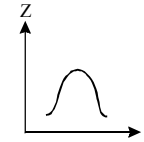
3. A resistance 'R' draws power 'P' when connected to an AC source. If an inductance is now placed in series with the resistance, such that the impedance of the circuit becomes 'Z', the power drawn will be

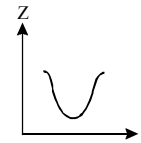
(a) $P\sqrt{\frac{R}{Z}}$ (b) $P\left(\frac{R}{Z}\right)$

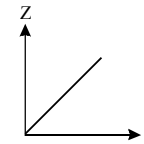
(c) P (d) $P\left(\frac{R}{Z}\right)^2$

4. Which one of the following curves represents the variation of impedance (Z) with frequency f in series LCR circuit?

(a) 

(b) 

(c) 

(d) 

5. For a series RLC circuit R = X_L = 2X_C. The impedance of the circuit and phase difference between V and I respectively will be

(a) $\frac{\sqrt{5}R}{3}, \tan^{-1}(2)$ (b) $\frac{\sqrt{5}R}{2}, \tan^{-1}(1/2)$

(c) $\sqrt{5}X_C, \tan^{-1}(2)$ (d) $\sqrt{5}R, \tan^{-1}(1/3)$

6. In an a.c. circuit V and I are given by

V = 100 sin (100 t) volt

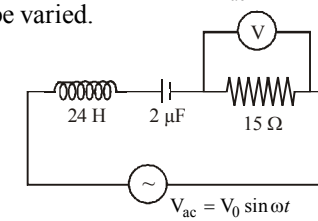
I = 100 sin (100 t + π/3) mA

The power dissipated in the circuit is

(a) 10^4 watt (b) 10 watt

(c) 2.5 watt (d) 5.0 watt

7. An LCR circuit as shown in the figure is connected to a voltage source V_{ac} whose frequency can be varied. The frequency, at which the voltage across the resistor is maximum, is :



(a) 902 Hz (b) 143 Hz

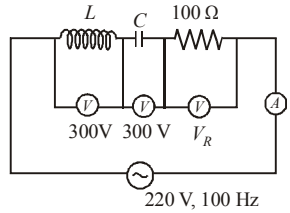
(c) 23 Hz (d) 345 Hz

8. The primary winding of a transformer has 500 turns whereas its secondary has 5000 turns. The primary is connected to an A.C. supply of 20 V, 50 Hz. The secondary will have an output of

(a) 2 V, 5 Hz (b) 200 V, 500 Hz

(c) 2V, 50 Hz (d) 200 V, 50 Hz

9. In an *LCR* circuit shown in the following figure, what will be the readings of the voltmeter across the resistor and ammeter if an *a.c.* source of 220V and 100 Hz is connected to it as shown?



(a) 800 V, 8 A (b) 110 V, 1.1 A

(c) 300 V, 3 A (d) 220V, 2.2 A

10. The primary and secondary coil of a transformer have 50 and 1500 turns respectively. If the magnetic flux ϕ linked with the primary coil is given by $\phi = \phi_0 + 4t$, where ϕ is in webers, t is time in seconds and ϕ_0 is a constant, the output voltage across the secondary coil is

(a) 120 volt (b) 220 volt

(c) 30 volt (d) 90 volt

11. An AC circuit has $R = 100\ \Omega$, $C = 2\ \mu F$ and $L = 80$ mH, connected in series. The quality factor of the circuit is :

(a) 2 (b) 0.5

(c) 20 (d) 400

12. In LC circuit the inductance L = 40 mH and capacitance C = 100 μF. If a voltage V(t) = 10 sin(314 t) is applied to the circuit, the current in the circuit is given as:

(a) 0.52 cos 314 t (b) 10 cos 314 t

(c) 5.2 cos 314 t (d) 0.52 sin 314 t

13. A power transmission line feeds input power at 2300 V to a step down transformer with its primary windings having 4000 turns. The output power is delivered at 230 V by the transformer. If the current in the primary of the transformer is 5A and its efficiency is 90%, the output current would be:

(a) 50 A (b) 45 A

(c) 35 A (d) 25 A

14. The power factor of an AC circuit having resistance (R) and inductance (L) connected in series and an angular velocity ω is

(a) $R/\omega L$ (b) $R/(R^2 + \omega^2 L^2)^{1/2}$

(c) $\omega L/R$ (d) $R/(R^2 - \omega^2 L^2)^{1/2}$

15. An alternating voltage $v(t) = 220 \sin 100\grave{A}t$ volt is applied to a purely resistive load of 50Ω. The time taken for the current to rise from half of the peak value to the peak value is :

(a) 5 ms (b) 2.2 ms

(c) 7.2 ms (d) 3.3 ms

16. An emf of 20 V is applied at time $t = 0$ to a circuit containing in series 10 mH inductor and 5 Ω resistor. The ratio of the currents at time $t = \infty$ and at $t = 40$ s is close to:

(Take $e^2 = 7.389$)

(a) 1.06 (b) 1.15

(c) 1.46 (d) 0.84

17. For an RLC circuit driven with voltage of amplitude v_m and frequency $\omega_0 = \frac{1}{\sqrt{LC}}$ the current exhibits resonance. The quality factor, Q is given by:

(a) $\frac{\omega_0 L}{R}$ (b) $\frac{\omega_0 R}{L}$

(c) $\frac{R}{(\omega_0 C)}$ (d) $\frac{CR}{\omega_0}$

18. A coil of inductance 300 mH and resistance 2 Ω is connected to a source of voltage 2V. The current reaches half of its steady state value in

(a) 0.1 s (b) 0.05 s

(c) 0.3 s (d) 0.15 s

19. A series AC circuit containing an inductor (20 mH), a capacitor (120 μF) and a resistor (60 Ω) is driven by an AC source of 24 V/50 Hz. The energy dissipated in the circuit in 60 s is:

(a) 5.65×10^2 J (b) 2.26×10^3 J

(c) 5.17×10^2 J (d) 3.39×10^3 J

20. In a series resonant LCR circuit, the voltage across R is 100 volts and $R = 1\ k\Omega$ with $C = 2\mu F$. The resonant frequency ω is 200 rad/s. At resonance the voltage across L is

(a) 2.5×10^{-2} V (b) 40 V

(c) 250 V (d) 4×10^{-3} V

Numeric Value Answer

21. A series AC circuit containing an inductor (20 mH), a capacitor (120 μF) and a resistor (60 Ω) is driven by an AC source of 24 V/50 Hz. The energy (in joule) dissipated in the circuit in 60 s is:

22. A power transmission line feeds input power at 2300 V to a step down transformer with its primary windings having 4000 turns. The output power is delivered at 230 V by the transformer. If the current in the primary of the transformer is 5A and its efficiency is 90%, the output current (in ampere) would be:

23. An alternating voltage $v(t) = 220 \sin 100\pi t$ volt is applied to a purely resistive load of 50 Ω. The time taken (in ms) for the current to rise from half of the peak value to the peak value is :

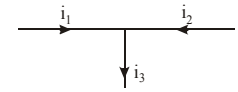
24. An inductor of inductance 100 mH is connected in series with a resistance, a variable capacitance and an AC source of frequency 2.0 kHz. What should be the value of the capacitance (in farad) so that maximum current may be drawn into the circuit ?

25. A 60 Hz AC voltage of 160 V impressed across an LR-circuit results in a current of 2 A. If the power dissipation is 200 W, calculate the maximum value of the back emf (in volt) arising in the inductance.

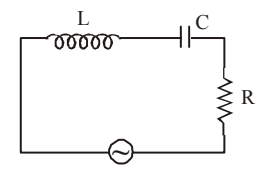
26. A 100 V AC source of frequency 500 Hz is connected to LCR circuit with $L = 8.1$ mH, C = 12.5 μF and $R = 10\Omega$, all connected in series. Find the potential (in volt) across the resistance.

27. A coil has a resistance of 10Ω and an inductance of 0.4 henry. It is connected to an AC source of 6.5 V, $\frac{30}{\pi} Hz$. Find the average power (in watt) consumed in the circuit.

28. If $i_1 = 3 \sin \omega t$, $i_2 = 4 \cos \omega t$, and $i_3 = i_0 \sin(\omega t + 53°)$, find the value of i_0.



29. Given LCR circuit has L = 5 H, C = 80 μF, R = 40 Ω and variable frequency source of 200 V. The source frequency (in Hz) which drives the circuit at resonance is $\frac{x}{\pi}$. Find the value of x.



30. An *LCR* series circuit with 100Ω resistance is connected to an AC source of 200 V and angular frequency 300 rad/s. When only the capacitance is removed, the current lags behind the voltage by 60°. When only the inductance is removed, the current leads the voltage by 60°. Calculate the current (in ampere) in the *LCR* circuit.

ANSWER KEY																			
1	(d)	**4**	(c)	**7**	(c)	**10**	(a)	**13**	(b)	**16**	(a)	**19**	(c)	**22**	(45)	**25**	(125)	**28**	(5)
2	(d)	**5**	(b)	**8**	(d)	**11**	(a)	**14**	(b)	**17**	(a)	**20**	(c)	**23**	(3.3)	**26**	(100)	**29**	(25)
3	(d)	**6**	(c)	**9**	(d)	**12**	(a)	**15**	(d)	**18**	(a)	**21**	(5.17×10^{2})	**24**	(65×10^{-9})	**27**	(0.625)	**30**	(2)