NEET ANSWER KEY & SOLUTIONS

SUBJECT :- PHYSICS
CLASS :- 12th **PAPER CODE :- CWT-6**
CHAPTER :- ALTERNATING CURRENT

ANSWER KEY

1.	(B)	**2.**	(C)	**3.**	(B)	**4.**	(B)	**5.**	(B)	**6.**	(C)	**7.**	(C)
8.	(D)	**9.**	(D)	**10.**	(A)	**11.**	(B)	**12.**	(D)	**13.**	(B)	**14.**	(C)
15.	(C)	**16.**	(B)	**17.**	(A)	**18.**	(B)	**19.**	(D)	**20.**	(A)	**21.**	(A)
22.	(B)	**23.**	(D)	**24.**	(B)	**25.**	(D)	**26.**	(B)	**27.**	(C)	**28.**	(B)
29.	(D)	**30.**	(D)	**31.**	(B)	**32.**	(A)	**33.**	(B)	**34.**	(C)	**35.**	(C)
36.	(C)	**37.**	(C)	**38.**	(B)	**39.**	(D)	**40.**	(D)	**41.**	(B)	**42.**	(D)
43.	(B)	**44.**	(C)	**45.**	(D)	**46.**	(A)	**47.**	(A)	**48.**	(B)	**49.**	(C)
50.	(D)												

SOLUTIONS

SECTION-A

1. (B)

Sol. Power $= I^2R = \left(\frac{I_p}{\sqrt{2}}\right)^2 R = \frac{I_p^2 R}{2}$

2. (C)

Sol. $v = \frac{\omega}{2\pi} = \frac{120 \times 7}{2 \times 22} = 19\ Hz$

$V_{r.m.s.} = \frac{240}{\sqrt{2}} = 120\sqrt{2}\ V$

3. (B)

Sol. In *dc* ammeter, a coil is free to rotate in the magnetic field of a fixed magnet.
If an alternating current is passed through such a coil, the torque will reverse it's direction each time the current changes direction and the average value of the torque will be zero.

4. (B)

Sol. $i_{r.m.s.} = \frac{i_o}{\sqrt{2}} = \frac{4}{\sqrt{2}} = 2\sqrt{2}\ ampere$

5. (B)

Sol. $V_0 = \sqrt{2}\ V_{rms} = 10\sqrt{2}$

6. (C)

Sol. $V_{rms} = \frac{200}{\sqrt{2}},\ i_{rms} = \frac{1}{\sqrt{2}}$

$\therefore P = V_{rms}\ i_{rms} \cos\phi = \frac{200}{\sqrt{2}} \frac{1}{\sqrt{2}} \cos\frac{\pi}{3} = 50\ watt$

7. (C)

Sol. $i_{rms} = \sqrt{\frac{i_1^2 + i_2^2}{2}} = \frac{1}{\sqrt{2}}(i_1^2 + i_2^2)^{1/2}$

8. (D)

Sol. $P = Vi\cos\phi$

Phase difference $\phi = \frac{\pi}{2} \Rightarrow P = zero$

9. (D)

Sol. $P = V_{rms} I_{rms} \cos\phi$; since $\phi = 90^o$. So $P = 0$

10. (A)

11. (B)

Sol. $Z = \sqrt{R^2 + X_L^2},\ X_L = \omega L$ and $\omega = 2\pi f$

$\therefore Z = \sqrt{R^2 + 4\pi^2 f^2 L^2}$

12. (D)

Sol. For the first circuit $i = \frac{V}{Z} = \frac{V}{\sqrt{R^2 + \omega^2 L^2}}$

$\therefore$ Increase in ω will cause a decrease in *i*.

For the second circuit $i = \frac{V}{\sqrt{R^2 + \frac{1}{\omega^2 C^2}}}$

$\therefore$ Increase in ω will cause an increase in *i*.

13. (B)

14. (C)

15. (C)

Sol. $Z = \sqrt{R^2 + (X_L - X_C)^2}$

$= \sqrt{100^2 + \left(0.5 \times 100\pi - \frac{1}{10 \times 10^{-6} \times 100\pi}\right)^2}$

$= 189.72\Omega$

16. (B)

Sol. In non resonant circuits

impedance $Z = \frac{1}{\sqrt{\frac{1}{R^2} + \left(\omega C - \frac{1}{\omega L}\right)^2}}$, with rise in frequency *Z* decreases *i.e.* current increases so circuit behaves as capacitive circuit.

17. (A)

Sol. In *LCR* circuit; in the condition of resonance $X_L = X_C$ *i.e.* circuit behaves as resistive circuit. In resistive circuit power factor is maximum.

18. (B)

Sol. $\cos\phi = \frac{R}{Z} = \frac{R}{(R^2+\omega L^2)^{1/2}}$

19. (D)

20. (A)

21. (A)

Sol. Capacitance of wire

$C = 0.014\times10^{-6}\times200 = 2.8\times10^{-6}\,F = 2.8\,\mu F$

For impedance of the circuit to be minimum

$X_L = X_C \Rightarrow 2\pi\nu L = \frac{1}{2\pi\nu C}$

$\Rightarrow L = \frac{1}{4\pi^2\nu^2 C} = \frac{1}{4(3.14)^2\times(5\times10^3)^2\times2.8\times10^{-6}}$

$= 0.35\times10^{-3}\,H = 0.35\,mH$

22. (B)

Sol. 1. *rms* value = $\frac{x_0}{\sqrt{2}}$

2.

$x_0\sin\omega t\cos\omega t = \frac{x_0}{2}\sin2\omega t \Rightarrow rms \text{ value } = \frac{x_0}{2\sqrt{2}}$

3.

$x_0\sin\omega t + x_0\cos\omega t \Rightarrow rms \text{ value } = \sqrt{\left(\frac{x_0}{\sqrt{2}}\right)^2+\left(\frac{x_0}{\sqrt{2}}\right)^2}$

$=\sqrt{x_0^2} = x_0$

23. (D)

Sol. As explained in solution (A) for frequency $0 - f_r$, Z decreases hence $(i = V/Z)$, increases and for frequency $f_r - \infty$, Z increases hence i decrees.

24. (B)

Sol. The phase angle for the *LCR* circuit is given by

$\tan\phi = \frac{X_L - X_C}{R} = \frac{\omega L - 1/\omega C}{R}$

Where X_L, X_C are inductive reactance and capacitive reactance respectively when $X_L > X_C$ then $\tan\phi$ is positive *i.e.* ϕ is positive (between 0 and $\pi/2$). Hence emf leads the current.

25. (D)

Sol. $P = I_{rms} V_{rms} \cos\frac{\pi}{2} = 0$

26. (B)

Sol. $Z = 100\ \Omega$ at f = 50Hz

$2\pi f \times L = X_L$

$\frac{f_1}{f_2} = \frac{X_{L_1}}{X_{L_2}}$

$\frac{50}{150} = \frac{100}{X_{L_2}}$

$X_{L_2} = 300\Omega$

27. (C)

Sol. The current lags the EMF by $\pi/2$, so the circuit should contain only an inductor.

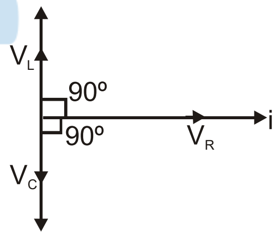
28. (B)

Sol. $i_{rms} = \frac{V_{rms}}{\sqrt{R^2+\frac{1}{\omega^2c^2}}}$

when ω increases, i_{rms} increases so the bulb glows brighter

29. (D)

Sol. In an LCR series a.c. circuit, the voltage across inductor L leads the current by 90° and the voltage across capacitor C lags behind the current by 90°



Hence, the voltage across LC combination will be zero.

30. (D)

Sol. When all (L,C,R) are connected then net phase difference = 60 – 60 = 0. So, there will be resonance.

$I = \frac{V}{R} = 2A$

$P = I^2 R = 400$ watt.

31. (B)

Sol. $\cos\phi = \frac{R}{Z}$

$Z_1 = 2R$, $Z_2 = 4R$

% change in impedence = 100%

32. (A)

Sol. V = 220 V, i = 5mA

Loss of power = 0

because power factor = 0

R = 0

33. (B)

Sol. $P = V_{rms} \cdot I_{rms} \cdot \cos\phi$

at maximum power $\cos\phi = 1$

but at half power $\cos\phi = \frac{1}{2}$

$V_{rms} \times I_{rms} \times \frac{1}{2} = P$

$V_{rms} \times I_{rms} \times \frac{1}{2} = \frac{V_{rms}}{\sqrt{2}} \times I$

$I = \frac{I_{rms}}{\sqrt{2}}$

$I = \frac{I_{rms}}{\sqrt{2}}$

34. (C)

Sol. $P = \frac{v^2}{R}$

$R = \frac{10 \times 10}{20} = 5\Omega$

for AC source

P = 10 watt

$\because P = v_{rms} \cdot \frac{v_{rms}}{Z} \times \frac{R}{Z}$

$10 = 10 \times \frac{10.R}{Z^2}$

$Z^2 = 10R$

$R^2 + X_L^2 = 10 \times R$

$25 + X_L^2 = 10 \times 5$

$X_L^2 = 25$

$X_L = \sqrt{25} = 5$

$\omega \times L = 5$

$f = \frac{5 \times 10^2}{2\pi} = \frac{250}{3.14} \approx 80$ Hz

35. (C)

Sol. Given : L = 10 H, *f* = 50 Hz.

For maximum power

$X_C = X_L$

$\frac{1}{\omega C} = L\omega$

$C = \frac{1}{\omega^2 L}$

$C = \frac{1}{4\pi^2 \times 50 \times 50 \times 10}$

$\therefore$ $C = 0.1 \times 10^{-5}$ F = 1 μF

SECTION-B

36. (C)

Sol. In the condition of resonance

$X_L = X_C$

or $\omega L = \frac{1}{\omega C}$

..............(i)

Since, resonant frequency remains unchanged,

so, $\sqrt{LC}$ = constant

or LC = constant

$\therefore$ $L_1C_1 = L_2C_2$

$\Rightarrow$ $L \times C = L_2 \times 2C$

$\Rightarrow$ $L_2 = \frac{L}{2}$

37. (C)

38. (B)

Sol. Given : i_p = 4 A, N_p = 140,

N_s = 280

From the formula

$\frac{i_p}{i_s} = \frac{N_s}{N_p}$ or $\frac{4}{i_s} = \frac{280}{140}$

So, i_s = 2A

39. (D)

Sol. P_{out} = 100 watt

$p_{in} = 200 \times 0.6$ watt.

= 120 watt

so $\eta = \frac{100}{120} \times 100\% = \frac{5}{6} \times 100\% = \frac{500}{6}\% =$ 83.33%

40. (D)

Sol. The current takes $\frac{T}{4}\,sec$ to reach the peak value.

In the given question $\frac{2\pi}{T} = 200\pi \Rightarrow T = \frac{1}{100}\,sec$

$\therefore$ Time to reach the peak value $= \frac{1}{400}\,sec$

41. (B)

Sol. $E = E_0 \cos \omega t = E_0 \cos \frac{2\pi t}{T}$

$= 10 \cos \frac{2\pi \times 50 \times 1}{600} = 10 \cos \frac{\pi}{6} = 5\sqrt{3}\ volt.$

42. (D)

Sol. $\because P = Vi\cos\phi, \therefore P \propto \cos\phi$

43. (B)

Sol. $P = \frac{V_{rms}^2}{R} = \frac{(30)^2}{10} = 90\ W$

44. (C)

Sol. Resonance frequency in *radian/second* is

$$\omega = \frac{1}{\sqrt{LC}} = \frac{1}{\sqrt{8 \times 0.5 \times 10^{-6}}} = 500\ rad/sec$$

45. (D)

Sol. $i = \frac{220}{\sqrt{(20)^2 + (2 \times \pi \times 50 \times 0.2)^2}} = \frac{220}{66} = 3.33\ A$

46. (A)

Sol. The voltage across a L–R combination is given by

$$V^2 = V_R^2 + V_L^2$$

$$V_L = \sqrt{V^2 - V_R^2} = \sqrt{400 - 144} = \sqrt{256} = 16\ volt.$$

47. (A)

Sol. Phase angle $\tan\phi = \frac{\omega L}{R} = \frac{2\pi \times 200}{300} \times \frac{1}{\pi} = \frac{4}{3}$

$$\therefore\ \phi = \tan^{-1}\frac{4}{3}$$

48. (B)

Sol. Resonance frequency

$$\omega = \frac{1}{\sqrt{LC}} = \frac{1}{\sqrt{8 \times 10^{-3} \times 20 \times 10^{-6}}} = 2500\ rad/\sec$$

Resonance current = $\frac{V}{R} = \frac{220}{44} = 5\,A$

49. (C)

Sol. $\cos\phi = \frac{R}{Z} = \frac{10}{20} = \frac{1}{2} \Rightarrow \phi = 60^o$

50. (D)

Sol. Impedance $Z = \sqrt{R^2 + 4\pi^2\nu^2L^2}$

$= \sqrt{(12)^2 + 4 \times (3.14)^2 \times (50)^2 \times (0.04)}$ = 17.37 A

Now current $i = \frac{V}{Z} = \frac{220}{17.37} = 12.7\Omega$