

Chapter- 7

Alternating Current

Very Short Answer Type Questions

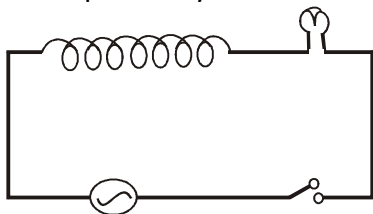
1 mark questions

01. Define r.m.s value of AC. [CBSE - 1996]
02. The instantaneous current from an ac source is given by $I = 6 \sin 314t$. What is the r.m.s value of current? [CBSE - 1999]
03. Define the average or mean value of AC. [CBSE - 2002]
04. What is the frequency of domestic alternating current supply? How many times does it become zero in one second? [CBSE - 2006]
05. A hot wire ammeter can measure (i) alternating current only (ii) Direct current only (iii) Both direct and alternating current. Write the correct alternative. [CBSE - 2009]
06. The electric main in a house is marked 220 v - 50 Hz. Write down the equation for instantaneous voltage. [CBSE - 1999]
07. Which one is more dangerous (i) 220v of DC (ii) 220v of AC. justify your answer. [CBSE - 1997]
08. What is the phase difference between the voltages across the inductor and a capacitor in an ac LCR series circuit?
09. What is the phase difference between voltage and current in an LCR series circuit at resonance? [CBSE - 1998]
10. Sketch a graph showing the variation of the reactance of a capacitor with the frequency of the applied voltage. [CBSE - 2000]
11. What is the power dissipated in an ac circuit in which voltage and current are given by $v = 230 \sin\left(\omega t + \frac{\pi}{2}\right)$ and $I = 10 \sin \omega t$? [CBSE - 2003]
12. The instantaneous current and voltage of the ac circuit are given by $I = 10 \sin 314t$ ampere, $v = 50 \sin 314t$ volt. What is the power dissipation in the circuit.? [CBSE - 2001]
13. For the circuit used for transporting electric power, a low power factor implies a large power loss in transmission. Explain why?
14. What are the minimum and maximum values of the power factor of a circuit can have? Under what circumstances can this occur?
15. The power factor can often be improved by the use of a capacitor of appropriate capacitance in the circuit. Explain. [CBSE - 1997]
16. Why is the power factor correction a must in heavy machinery? [CBSE - 1996]
17. In an LCR series ac circuit, the voltage across each of the components L, C R is 50 V. What is the voltage across the LC combination?

18. In an ac circuit voltage applied is $E = \varepsilon_0 \sin \omega t$ and the current is $i = i_0 \sin(\omega t - \pi/2)$. What is the average power consumption of the circuit?
19. An AC source of variable angular frequency ω and fixed amplitude V_0 is connected in series with a capacitance C and an electric bulb of resistance $R(L=0)$. How will the glowing of bulb be affected by increasing ω ?
20. What is the impedance of a circuit consisting of 3Ω resistance and 4Ω reactance?
21. In an AC circuit after what time current becomes equal to its rms value for the first time starting from 0 if the time period is T ?
22. What is the dimensional formula of \sqrt{LC} ?
23. Why is the core of the transformer laminated?
24. In an LCR circuit, the capacitance is changed from C to $2C$. For the resonant frequency to remain unchanged, the inductance should be changed from L to _____.
25. Why step-up transformer is used at power generating stations?
26. Write the difference between step up and step down transformer based on their construction.
27. Windings of secondary coils are made thicker in a step-down transformer. Why?
28. In an ac series LCR circuit with fixed L and C and variable R , how the sharpness of the resonance curve be affected with a variation of R ?
29. A capacitor is initially fully charged and then discharges through a pure inductor and produces electrical oscillation of the period T . After what time of starting electrostatic energy and magnetic energy become equal for the first time?

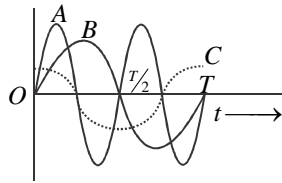
2 marks questions

30. Prove that the voltage and current always in the same phase in an a.c circuit containing resistance only. Show this phase relationship graphically. [CBSE - 1999]
31. Prove that an ideal inductor does not dissipate power in an a.c circuit. [CBSE - 2001]
32. Prove that an ideal resistor dissipates the power of $\frac{V_{\text{eff}}^2}{R}$ in an AC circuit. [CBSE - 2005]
33. Define the power factor of an A.C circuit (ii) What are the maximum and minimum values of the power factor of an A.C circuit. [CBSE - 2000]
34. A pure inductor of 25mH has connected 10 A source of 220V. Find the inductive reactance and rms current in the circuit if the frequency of the source is 50Hz. [CBSE - 1996]
35. A light bulb and open coil inductor are connected to an a.c through a key. [CBSE 1998]
After some time the key is close and an iron rod is inserted into the inductor (i) Will the glow of light (a) increase (b) decrease (c) remain same (ii) What will be your answer of a.c is replaced by d.c



36. A voltage is applied to an element X and variation of different factors with time are shown by graphs A, B, C. (a) Identify X and quantities whose graphs are A, B, and C

(b) Plot a graph between the impedance of the element with the frequency of ac

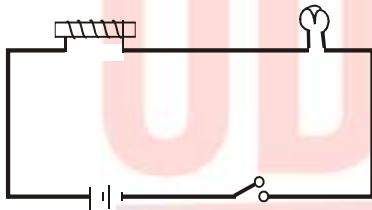


37. A lamp is connected in series with a capacitor. Predict your observation for d.c and a.c connections. What happens in the case of the capacitance of the capacitor is reduced?
[CBSE1997]

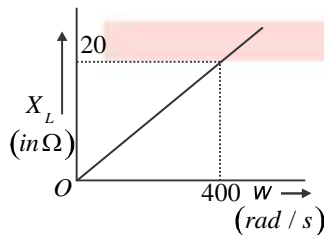
38. Fig. shows a light bulb (B) and an iron cored inductor connected to a.c through a key (s)

(i) What will one observe when the key is closed?

(ii) How will the glow of bulb change, if the battery is replaced by a.c (whose rms value = voltage of battery)



39. $X_L \sim \omega$ graph of an inductor is shown in the graph. If the inductor is connected across a 220 V - 50 Hz source then what is the rms current?

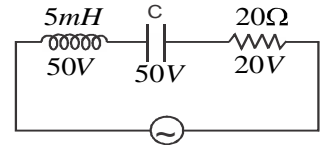


40. Can the current produced by an ac generator be measured with a moving coil ammeter? Explain your answer.

3 marks questions

41. A 15F capacitor is connected to a 220V, 50Hz source. Find the capacitive reactance and the current in the circuit. If the frequency is doubled, what happens to the capacitive reactance and the current.

42. The frequency of a.c is doubled. How do R , X_L and X_C get affected.? [CBSE - 2005]
43. An alternating emf is applied across a capacitor. Show mathematically that current in it leads the applied emf by a phase angle of $\pi/2$. What is its capacitive reactance? Draw a graph showing the variation of a capacitive reactance with the frequency of the a.c source. [CBSE - 2003]
44. An alternating emf is applied across a capacitor. Show mathematically that current in it leads the applied emf by a phase angle of $\frac{\pi}{2}$. What is its capacitive reactance? Draw a graph showing the variation of a capacitive reactance with the frequency of the a.c source. [CBSE - 2003]
45. What do you mean by the sharpness of resonance in a series resonant circuit? Find an expression for Q-factor of the circuit.? [CBSE - 1994]
46. In the given circuit, find (i) RMS current (ii) Angular frequency of AC (iii) Capacitance C



47. (a) A capacitor of $50\mu F$, a resistor of 10Ω , and an inductor L are connected in series with an a.c. source of 50Hz . Calculate the value of L if the phase angle between the current and voltage is zero.
 (b) The natural frequency of a circuit of negligible resistance, capacitance C and inductance L is 1600 Hz . Calculate the frequency when the values of both L and C are doubled.
48. When a coil is connected to 220 v d.c source, a current of 2A flows through the circuit and when the same coil is connected to a $220\text{ V, }50\text{Hz}$ a.c source the current is 1 A
 (a) Explain why the current decreases in the latter case.
 (b) Calculate the self-inductance of the coil.
49. Calculate the current drawn by the primary coil of a transformer which steps down 220 v to 20V to operate a device of resistance 20Ω . Assume the efficiency of the transformer to be 80% .

5 marks questions

50. An inductor L , a capacitor C , and a resistor R are connected in series in an a.c circuit. Deduce with the help of suitable diagrams, a mathematical expression for impedance of the circuit. What is meant by the resonance of this circuit? prove that this circuit exhibits resonance at a frequency given by
51. Explain with the help of a labeled diagram, the principle, construction, and working of a transformer. Why is its core laminated?
52. (a) Define bandwidth and q-factor of an ac circuit. Explain their significance.
 (b) A 200 mH inductor, a $500\mu F$ capacitor, and a 10Ω resistor are connected in series with a 100V variable frequency a.c source. Calculate
 (i) The frequency at which the power factor of the circuit is unity
 (ii) The current amplitude at this frequency
 (iii) The Q-factor.
53. (a) By using the phasor diagram method, obtain impedance of a series LCR ac circuit. Also, find the phase difference between current and voltage in the circuit.

$$\frac{1}{2\pi\sqrt{LC}}$$

- (b) What is the major drawback of the phasor diagram method to simplify the ac circuit?
- (c) Write down the expressions for bandwidth and q-factor.
- 54.** When an alternating voltage of 220 V is applied across a device P, a current of 0.25 A flows through the circuit and it leads the applied voltage by $\pi / 2$ rad. When the same voltage is applied across another device Q, the same current flows through the circuit and is in phase with the applied voltage.
- (a) Name the devices P and Q.
- (b) Calculate the current flowing through the circuit when the same voltage is applied across a series combination of P and Q.

