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CLASS 12 PHYSICS · NCERT CHAPTER 7 · IMU CET PRACTICE

Alternating Current

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Questions: 44 MCQs

Each question has exactly one correct option. Attempt all questions first, then check the Answer Key and Solutions at the end.

- 1 The rms value of an alternating current of peak value I_0 is
(A) $\sqrt{2} I_0$ (B) $I_0/2$
(C) I_0 (D) $I_0/\sqrt{2}$
- 2 The domestic AC supply in India is 220 V rms. Its peak value is about
(A) 440 V (B) 220 V
(C) 311 V (D) 156 V
- 3 The average value of AC over one complete cycle is
(A) I_0 (B) zero
(C) $2I_0/\pi$ (D) $I_0/\sqrt{2}$
- 4 The average value of AC over a half cycle is
(A) $I_0/2$ (B) $I_0/\sqrt{2}$
(C) zero (D) $2I_0/\pi$
- 5 The frequency of domestic AC in India is
(A) 50 Hz (B) 220 Hz
(C) 60 Hz (D) 100 Hz
- 6 In a purely resistive AC circuit, the current and voltage are
(A) out of phase by $\pi/2$ (B) out of phase by π
(C) in phase (D) out of phase by $\pi/4$
- 7 In a purely inductive AC circuit, the current
(A) lags by π (B) is in phase with voltage
(C) lags the voltage by $\pi/2$ (D) leads the voltage by $\pi/2$
- 8 In a purely capacitive AC circuit, the current
(A) lags the voltage by $\pi/2$ (B) leads by π
(C) is in phase with the voltage (D) leads the voltage by $\pi/2$
- 9 Inductive reactance is
(A) L/ω (B) ωL
(C) ω/L (D) $1/\omega L$



- 10 Capacitive reactance is
(A) C/ω (B) ω/C
(C) $1/\omega C$ (D) ωC
- 11 For a DC source, the reactance of a capacitor is
(A) infinite (B) $1\ \Omega$
(C) equal to its resistance (D) zero
- 12 The inductive reactance of a 0.1 H inductor at 50 Hz is
(A) $5\ \Omega$ (B) $3.14\ \Omega$
(C) $31.4\ \Omega$ (D) $314\ \Omega$
- 13 The capacitive reactance of a $100\ \mu\text{F}$ capacitor at 50 Hz is about
(A) $0.0318\ \Omega$ (B) $3.18\ \Omega$
(C) $318\ \Omega$ (D) $31.8\ \Omega$
- 14 The impedance of a series LCR circuit is
(A) $\sqrt{R^2 + X_L^2 + X_C^2}$ (B) $R + X_L - X_C$
(C) $R + X_L + X_C$ (D) $\sqrt{R^2 + (X_L - X_C)^2}$
- 15 In a series LCR circuit, $R = 30\ \Omega$, $X_L = 80\ \Omega$ and $X_C = 40\ \Omega$. The impedance is
(A) $10\ \Omega$ (B) $50\ \Omega$
(C) $150\ \Omega$ (D) $70\ \Omega$
- 16 The resonant frequency of a series LCR circuit is
(A) $1/\sqrt{LC}$ (B) $\sqrt{LC}/2\pi$
(C) $2\pi\sqrt{LC}$ (D) $1/(2\pi\sqrt{LC})$
- 17 At resonance in a series LCR circuit,
(A) $X_L > X_C$ (B) impedance is minimum and equal to R
(C) current is minimum (D) impedance is maximum
- 18 At resonance, the phase difference between voltage and current in a series LCR circuit is
(A) $\pi/2$ (B) zero
(C) $\pi/4$ (D) π
- 19 An inductor of 1 mH and a capacitor of $10\ \mu\text{F}$ form a series LC circuit. The resonant angular frequency is
(A) $10^2\ \text{rad/s}$ (B) $10^5\ \text{rad/s}$
(C) $10^3\ \text{rad/s}$ (D) $10^4\ \text{rad/s}$
- 20 The quality factor Q of a series LCR circuit is
(A) $\omega_0 L/R$ (B) $\omega_0 R/L$
(C) $R/\omega_0 L$ (D) LR/ω_0
- 21 The average power in an AC circuit is
(A) $V_0 I_0$ (B) $V_{\text{rms}} I_{\text{rms}} \sin \phi$
(C) $V_{\text{rms}} I_{\text{rms}} \cos \phi$ (D) $V_{\text{rms}} I_{\text{rms}}$



- 22** The power factor of a purely inductive circuit is
(A) zero (B) 0.5
(C) 0.707 (D) 1
- 23** The power factor of a purely resistive circuit is
(A) 0.5 (B) infinite
(C) zero (D) 1
- 24** The current in a purely inductive or capacitive circuit is called wattless current because
(A) average power consumed is zero (B) resistance is infinite
(C) the voltage is zero (D) the current is zero
- 25** In a series LCR circuit, $R = 40\ \Omega$ and $Z = 50\ \Omega$. The power factor is
(A) 1.25 (B) 0.6
(C) 0.5 (D) 0.8
- 26** A transformer works on the principle of
(A) self-induction (B) mutual induction
(C) eddy currents only (D) electrostatic induction
- 27** A transformer cannot work with DC because
(A) DC does not produce a changing flux (B) DC has too high voltage
(C) DC heats the core (D) DC reverses direction
- 28** In a step-up transformer,
(A) $N_s = N_p$ (B) $N_s > N_p$ and $I_s > I_p$
(C) $N_s > N_p$ and $V_s > V_p$ (D) $N_s < N_p$ and $V_s > V_p$
- 29** A transformer has 100 primary and 500 secondary turns. With 220 V input, the output is
(A) 500 V (B) 1100 V
(C) 44 V (D) 220 V
- 30** An ideal transformer steps 220 V down to 11 V. If the secondary current is 4 A, the primary current is
(A) 0.2 A (B) 80 A
(C) 2 A (D) 4 A
- 31** Power is transmitted over long distances at high voltage to
(A) make the lines safe
(B) reduce I^2R losses in transmission lines
(C) increase resistance
(D) increase current
- 32** Energy loss in a transformer due to hysteresis is reduced by using
(A) steel core (B) copper core
(C) soft iron core (D) wooden core



- 33** If the frequency of AC increases, the inductive reactance
(A) remains constant (B) increases
(C) decreases (D) becomes zero
- 34** If the frequency of AC increases, the capacitive reactance
(A) increases (B) remains constant
(C) becomes infinite (D) decreases
- 35** An LC circuit oscillates. The energy oscillates between
(A) electric field of capacitor and magnetic field of inductor
(B) inductor and resistor
(C) resistor and capacitor
(D) battery and capacitor
- 36** The frequency of LC oscillations with $L = 4 \text{ mH}$ and $C = 25 \text{ } \mu\text{F}$ is about
(A) 3162 Hz (B) 159 Hz
(C) 503 Hz (D) 50 Hz
- 37** An AC voltage $V = 200 \sin 314t$ is applied across a $100 \text{ } \Omega$ resistor. The rms current is
(A) 1.41 A (B) 1 A
(C) 3.14 A (D) 2 A
- 38** The frequency of the AC voltage $V = 200 \sin 314t$ is
(A) 50 Hz (B) 60 Hz
(C) 314 Hz (D) 100 Hz
- 39** A choke coil is preferred over a resistor to control current in AC circuits because
(A) it increases power factor to 1 (B) it consumes negligible power
(C) it is cheaper (D) it works on DC too
- 40** In a series LCR circuit at resonance, the voltage across L and C are
(A) zero individually
(B) in phase
(C) equal in magnitude and opposite in phase
(D) equal to the source voltage always
- 41** In a series RC circuit with $R = X_C$, the phase difference between current and voltage is
(A) 45° , current leading (B) 0°
(C) 45° , current lagging (D) 90°
- 42** The bandwidth of a series resonant circuit is related to the quality factor as
(A) $\Delta\omega = Q/\omega_0$ (B) $\Delta\omega = \omega_0^2 Q$
(C) $\Delta\omega = \omega_0/Q$ (D) $\Delta\omega = Q\omega_0$
- 43** The efficiency of a transformer that gives 90 W output for 100 W input is
(A) 111% (B) 10%
(C) 100% (D) 90%



- 44** A 60 W, 120 V lamp is to be operated on a 240 V AC line using an inductor in series (pure inductance). The required inductive reactance is about
- (A) 120 Ω (B) 416 Ω
(C) 832 Ω (D) 240 Ω
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Answer Key

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

Hints & Solutions

1. (D) $I_{\text{rms}} = I_0/\sqrt{2} \approx 0.707 I_0$.
2. (C) $V_0 = \sqrt{2} \times 220 \approx 311 \text{ V}$.
3. (B) Positive and negative half cycles cancel.
4. (D) $I_{\text{avg}} (\text{half cycle}) = 2I_0/\pi \approx 0.637 I_0$.
5. (A) Indian mains supply is 50 Hz.
6. (C) $V = IR$ at every instant.
7. (C) For an inductor, $V = L \, di/dt$, so i lags V by 90° .
8. (D) $i = C \, dV/dt$, so current leads voltage by 90° .
9. (B) $X_L = \omega L = 2\pi fL$.
10. (C) $X_C = 1/(\omega C)$.
11. (A) $f = 0 \rightarrow X_C = 1/(2\pi fC) \rightarrow \infty$, so a capacitor blocks DC.
12. (C) $X_L = 2\pi \times 50 \times 0.1 = 31.4 \, \Omega$.
13. (D) $X_C = 1/(2\pi \times 50 \times 10^{-4}) = 1/0.0314 \approx 31.8 \, \Omega$.
14. (D) $Z = \sqrt{R^2 + (X_L - X_C)^2}$.
15. (B) $Z = \sqrt{30^2 + 40^2} = 50 \, \Omega$.
16. (D) $X_L = X_C \rightarrow \omega_0 = 1/\sqrt{LC} \rightarrow f_0 = 1/(2\pi\sqrt{LC})$.
17. (B) $X_L = X_C$, so $Z = R$ (minimum) and current is maximum.
18. (B) The circuit is purely resistive at resonance.
19. (D) $\omega_0 = 1/\sqrt{10^{-3} \times 10^{-5}} = 1/\sqrt{10^{-8}} = 10^4 \text{ rad/s}$.
20. (A) $Q = \omega_0 L/R = (1/R)\sqrt{L/C}$. Higher Q means sharper resonance.
21. (C) $P = V_{\text{rms}} I_{\text{rms}} \cos \phi$, where $\cos \phi$ is the power factor.
22. (A) $\phi = 90^\circ \rightarrow \cos \phi = 0$.
23. (D) $\phi = 0 \rightarrow \cos \phi = 1$.



24. (A) With $\phi = 90^\circ$, $P_{\text{avg}} = V I \cos 90^\circ = 0$.
25. (D) $\cos \phi = R/Z = 0.8$.
26. (B) Changing current in the primary induces emf in the secondary via mutual induction.
27. (A) Steady current gives constant flux, so no emf is induced in the secondary.
28. (C) $V_s/V_p = N_s/N_p > 1$; current steps down correspondingly.
29. (B) $V_s = 220 \times 500/100 = 1100 \text{ V}$.
30. (A) $V_p I_p = V_s I_s \rightarrow I_p = 11 \times 4/220 = 0.2 \text{ A}$.
31. (B) For the same power, high voltage means low current and hence low $I^2 R$ loss.
32. (C) Soft iron has a narrow hysteresis loop (low energy loss per cycle).
33. (B) $X_L = 2\pi f L \propto f$.
34. (D) $X_C = 1/(2\pi f C) \propto 1/f$.
35. (A) LC oscillations exchange energy between $\frac{1}{2}q^2/C$ and $\frac{1}{2}LI^2$.
36. (C) $\omega = 1/\sqrt{4 \times 10^{-3} \times 25 \times 10^{-6}} = 1/\sqrt{10^{-7}} \approx 3162 \text{ rad/s} \rightarrow f = 3162/2\pi \approx 503 \text{ Hz}$.
37. (A) $I_0 = 2 \text{ A} \rightarrow I_{\text{rms}} = 2/\sqrt{2} \approx 1.41 \text{ A}$.
38. (A) $\omega = 314 = 2\pi f \rightarrow f = 50 \text{ Hz}$.
39. (B) An ideal choke has $\phi \approx 90^\circ$, so average power loss is nearly zero.
40. (C) $V_L = IX_L$ and $V_C = IX_C$ are equal and 180° apart, cancelling each other.
41. (A) $\tan \phi = X_C/R = 1 \rightarrow \phi = 45^\circ$, current leads in a capacitive circuit.
42. (C) $Q = \omega_0/\Delta\omega$, so sharper resonance (higher Q) means smaller bandwidth.
43. (D) $\eta = \text{output/input} = 90/100$.
44. (B) $R = 120^2/60 = 240 \Omega$; $I = 0.5 \text{ A}$. $Z = 240/0.5 = 480 \Omega \rightarrow X_L = \sqrt{480^2 - 240^2} = \sqrt{172800} \approx 416 \Omega$.

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