CHAPTER-7
Alternating Current
ASSIGNMENT-2
MULTIPLE CHOICE QUESTION

Q1. In LCR circuit, the capacitance is changed from C to 4C. For the same resonant frequency, the inductance should be changed from L to

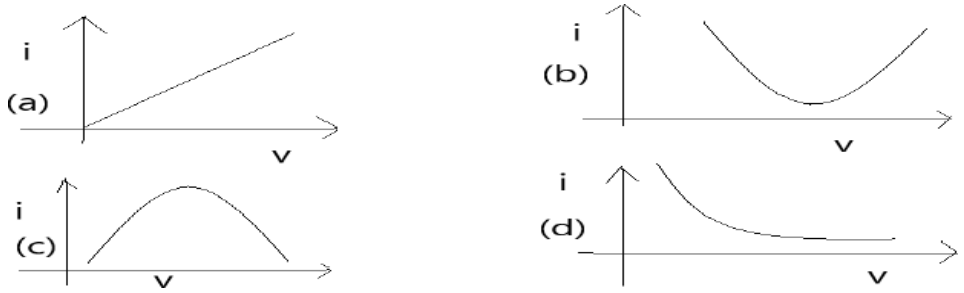
(a) 2L (b) L / 2 (c) L / 4 (d) 4 L

Q2. A bulb and a capacitor are connected in series to a source of alternating current. If its frequency is increased, while keeping the voltage of the source constant, then

(a) Bulb will give more intense light (b) Bulb will give less intense light

(c) Bulb will give light of same intensity as before (d) Bulb will stop radiating light

Q3. The i - ν curve for anti-resonant circuit is



Assertion-Reasoning Question:

(a) If both assertion and reason are true and the reason is the correct explanation of the assertion.

(b) If both assertion and reason are true but reason is not the correct explanation of the assertion.

(c) If assertion is true but reason is false.

(d) If the assertion and reason both are false

Q4. **Assertion**: When capacitive reactance is smaller than the inductive reactance in LCR current, e.m.f. leads the current.

Reason: The phase angle is the angle between the alternating e.m.f and alternating current of the circuit.

Q5. **Assertion**: A capacitor of suitable capacitance can be used in an ac circuit in place of the choke coil.

Reason: A capacitor blocks dc and allows ac only.

Q6. If rotational velocity of an a.c. generator armature is doubled, then induced e.m.f will become

(a) Half (b) Two times (c) Four times (d) Unchanged

Q7. In a step-up transformer, the turn ratio is 1: 2. A Leclanche cell (e.m.f. 1.5V) is connected across the primary. The voltage developed in the secondary would be

(a) 3.0 V (b) 0.75 V (c) 1.5 V (d) Zero

Q8. In a step-up transformer the turn ratio is 1:10. A resistance of 200 ohm connected across the secondary is drawing a current of 0.5 A. What is the primary voltage and current?

(a) 50 V, 1 amp (b) 10 V, 5 amp (c) 25 V, 4 amp (d) 20 V, 2 amp

Q9. **Assertion**: A given transformer can be used to step-up or step-down the voltage.

Reason: The output voltage depends upon the ratio of the number of turns of the two coils of the transformer.

SHORT ANSWER TYPE I (2MARKS EACH)

Q10.Define power factor. State the conditions under which it is (i) maximum and (ii) minimum.

Q11.In a series LCR circuit with an ac source of effective voltage 50 V, frequency $\nu = 50/\pi$ Hz, R = 300 Ω, C = 20 μF and L = 1.0 H. Find the rms current in the circuit.

Q12.An output voltage of an ideal transformer connected to 240 V ac mains is 24V. When the transformer used to light a bulb 24V, 24W Calculate the current in the primary of the circuit.

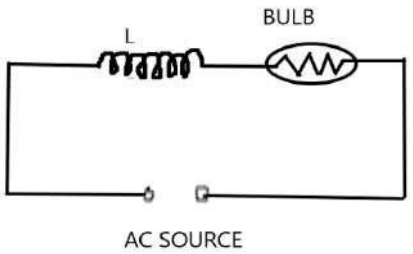
SHORT ANSWER TYPE II (3MARKS EACH)

Q13.A series LCR circuit is connected to an ac source (200 V, 50 Hz). The voltages across the resistor, capacitor and inductor are respectively 200 V, 250 V and 250 V.

(i) The algebraic sum of the voltages across the three elements is greater than the voltage of the source. How is this paradox resolved?

(ii) Given the value of the resistance of R is 40 W, calculate the current in the circuit.

Q14.An inductor L of reactance X_L is connected in series with a bulb B to an ac source as shown in figure. Explain briefly how does the brightness of the bulb change when (i) number of turns of the inductor is reduced (ii) an iron rod is inserted in the inductor and (iii) a capacitor of reactance $X_C = X_L$ is included in the circuit.



LONG ANSWER TYPE (5MARKS EACH)

Q15. (a) An ac source of voltage $V = V_0 \sin \omega t$ is connected to a series combination of L, C and R. Use the phasor diagram to obtain expressions for impedance of the circuit and phase angle between voltage and current. Find the condition when current will be in phase with the voltage. What is the circuit in this condition called?

(b) In a series L R circuit $X_L = R$ and power factor of the circuit is P_1. When capacitor with capacitance C such that $X_L = X_C$ is put in series, the power factor becomes P_2. Calculate P_1 / P_2 .

Q16. (a) An alternating voltage $V = V_m \sin \omega$ applied to a series LCR circuit drives a current given by $i = i_m \sin (\omega t + \varphi)$. Deduce an expression for the average power dissipated over a cycle.

(b) For circuits used for transporting electric power, a low power factor implies large power loss in transmission. Explain.

Q17. Draw a schematic diagram of a step-up transformer. Explain its working principle. Deduce the expression for the secondary to primary voltage in terms of the number of turns in the two coils. In an ideal transformer, how is this ratio related to the currents in the two coils? How is the transformer used in large scale transmission and distribution of electrical energy over long distances?

CASE STUDY TYPE (4 MARKS EACH)

Q18. An airport metal is essentially a resonant circuit. The portal you step through is an inductor (a large loop of conducting wire) that is part of the circuit. The frequency of the circuit is tuned to the resonant frequency of the circuit when there is no metal in the inductor. Any metal on your body increases the effective inductance of the loop and changes the current in it. When you pass through a metal detector, you become part of a resonant circuit. As you step through the detector, the inductance of the circuit changes, and thus the current in the circuit changes.

1. What is resonance?
2. On what factors does resonance frequency depends?
3. For the metal detector to detect a small metal object the sharpness of the current versus frequency graph be more or less? Justify your answer.
4. What is impedance of the circuit at resonance?