

Chapter- 7.

ALTERNATING CURRENT

One mark questions

1. What is the phase angle between current and voltage across a resistor when AC is applied to a pure resistor? (K)
2. Draw a graph representing current and voltage across a resistor when AC is applied to a pure resistor. (S)
3. Define root mean square value of current or voltage. (U)
4. Write the expression for the power dissipated in the resistor when AC is passed through it. (K)
5. How the RMS value and peak value of current /voltage are related? (U)
6. If the peak value of current is 1.41A, then what is the value of root mean square current? (A)
7. What is a phasor diagram in AC circuits? (U)
8. How does the bandwidth of LCR series circuit vary with quality factor? (U)
9. Define power factor in an AC circuit. (U)
10. What is wattles current? (U)
11. The peak voltage of an AC supply is 300 V. What is the RMS voltage? (A)
12. Write the expression for inductive reactance in terms of frequency of AC applied. (K)
13. Write the expression for capacitive reactance in terms of frequency of AC applied. (K)
14. What is the value of average power supplied to an inductor in one complete cycle of AC? (K)
15. What is the power factor of an AC circuit containing a pure inductor? (K)
16. What is the power factor of an AC circuit containing only capacitor? (K)
17. What is the power factor of an AC circuit containing only pure resistor? (K)
18. Draw impedance diagram of a series LCR circuit. (S)
19. Give the expression for power factor in an AC circuit containing an inductor, a capacitor and a resistor in series. (K)
20. What is electrical resonance in RLC series circuit? (U)
21. Define resonant frequency of an RLC series circuit. (U)
22. Define band width of LCR series circuit. (U)
23. Write the expression for Q factor or quality factor of an AC circuit. (K)
24. An AC source is connected to a 3pF capacitor and 3Ω resistor in series. Can we have resonance phenomena in it? (K)
25. The power factor of an AC circuit is 0.5. What is the phase angle between voltage and current in the circuit? (A)
26. What is an ideal transformer? (K)
27. On what principle a transformer works? (K)
28. The number of turns in the primary of a transformer is greater than the number of turns in the secondary. Does the voltage steps-up or steps down in it? (U)
29. What is a step-up transformer? (K)

30. What is a step-down transformer? (K)
31. What is the reactance of an inductor in a dc circuit carrying a steady current? (K)
32. Why voltage is stepped up in large scale transmission? (U)
33. Which physical quantity in electrical system is analogue to 'mass' of the mechanical system? (U)

Two mark questions

1. Mention any two advantages of AC over DC. (K)
2. What is quality factor in an LCR series circuit? Give the expression for it. (K)
3. Write the expression for resonant frequency of RLC series circuit and explain the terms. (K)
4. Give the expression for quality factor in a RLC series circuit. Explain the symbols used. (K)
5. Alternating current is represented by the equation $I = I_0 \sin(314)t$. Find the value of frequency of AC. (A)
6. Write any two differences between inductive reactance and capacitive reactance. (U)
7. Give any two differences between step- up transformer and step- down transformer. (U)
8. An AC source of voltage $V = V_0 \sin \omega t$ is connected to an ideal inductor. Draw phasor diagram for the circuit. (S)
9. What is the phase difference between voltage and current when an AC is connected to a capacitor? Represent it using phasor diagram. (S)
10. What is the phase difference between voltage and current when an AC is connected to an inductor? Represent it using phasor diagram. (S)
11. What is the phase difference between voltage and current when an AC is connected to a resistor? Represent it using phasor diagram. (S)
12. Draw a graph of variation of voltage and current versus ωt in case of an inductor connected to an AC source. (S)
13. Draw a graph of variation of voltage and current versus ωt in case of a resistor connected to an AC source. (S)
14. Draw a graph of variation of voltage and current versus ωt in case of an inductor connected to an AC source. (S)
15. What is capacitive reactance? Give the expression for it in terms of frequency of applied AC. (K)
16. What is inductive reactance? Give the expression for it in terms of frequency of applied AC. (K)
17. A power transmission line feeds input power at 2300 V to a step down transformer with its primary windings having 4000 turns. What should be the number of turns in the secondary in order to get output power at 230 V? (A)
18. A charged 30 μF capacitor is connected to a 27 mH inductor. What is the angular frequency of free oscillations of the circuit? (A)

Three mark questions

1. Derive the expression for current in case of AC applied to a pure resistor. (U)
2. Obtain the expression for current in case of AC applied to an inductor. (U)
3. Derive the expression for current through a capacitor when AC is applied. (U)

4. Show that the average power over one complete cycle is zero in case of a capacitor connected in series with AC. (A)
5. Derive the expression for the average power dissipated in a series RLC circuit. (U)
6. What is resonance in LCR series circuit? Obtain the expression for resonant frequency of it. (U)
7. Give the theory of LC oscillator. (U)
8. Explain how an LC circuit behaves as an oscillator. (U)
9. Define band width of LCR series circuit. Give an expression for band width explaining terms used. (U)
10. Mention any three energy losses in a transformer. (K)
11. Explain how power is dissipated by writing the expression for power factor in case of (i) pure inductive or capacitive (ii) series LCR (iii) series LCR at resonance circuits. (U)

Five mark questions

1. Show that the relation between AC current and AC voltage in case of AC applied to a resistor is similar to that in the DC applied to it. (U)
2. Derive the expression for instantaneous current when AC voltage is applied to a pure inductor. Draw phasor diagram for the circuit and represent graphically. (S)
3. Show that the instantaneous value of current is 90° ahead of voltage in case of AC applied to a capacitor. Represent it graphically. (S)
4. Derive the expression for impedance and hence the current of an RLC series circuit connected to an AC using phasor diagram. (U)
5. Show that average power over a complete cycle in a pure inductor connected to an AC source is zero. (A)
6. Derive the expression for quality factor of a series RLC circuit connected to AC source. (U)
7. Give the construction and working of a transformer. (U)
8. What is a transformer? Mention the energy losses of a transformer. (K)

Numerical problems

1. A 50Ω resistor, 0.5H inductor and $200\mu\text{F}$ capacitor are connected in series with 220V and 50Hz source. Find the impedance of the circuit and hence the current. (A) **[149.7 Ω , 1.47A]**
2. A current of 4A flows in a coil when connected to a 12V d.c. source. If the same coil is connected to 12V , 50Hz a.c. source, a current of 2.4A flows in the circuit. Calculate the self-inductance of the coil. (A) **[80mH]**
3. A resistance of 10Ω is connected in series with an inductor of inductance 0.5H . These two are connected to 200V , 50Hz a.c. source. Calculate the capacitance that should be put in series with the combination to obtain the maximum current? Also find the current through the circuit. (A) **[20.24 μF , 20A]**
4. A source of 220V , 40Hz is connected to a series combination of 6Ω resistor, 0.01H inductor. Calculate the phase angle and the power factor of the circuit. (A) **[22 $^\circ$ 42', 0.92]**

5. In a step-down transformer having primary to secondary turns ratio 20:1, the input voltage applied is 250V and output current is 8A. Assuming 100% efficiency calculate (i) voltage across the secondary coil, (ii) current in primary coil (iii) output power. (A) **[12.5V, 0.4A, 100W]**
