

## Chapter 13. A.C CIRCUITS

### MCQ'S (1 Mark Each)

1) An electric current in an LC – circuit at resonance is called -

- a) The wattless current
- b) The displacement current.
- c) The idle current
- d) The apparent current

**Ans: a) The wattless current**

2) In a series LCR circuit at resonance, the applied emf and current are -

- a) Out of phase
- b) Differ in phase by  $\pi/4$  radian.
- c) Differ in phase by  $\pi/2$  radian.
- d) In phase

**Ans: d) In phase**

3) A series LCR resonant circuit is used as

- a) A potential divider circuit.
- b) A radio wave transmitter
- c) A source of displacement current
- d) A tuning circuit in a television receiver set.

**Ans: d) A tuning circuit in a television receiver set.**

4) If AC voltage is applied to pure capacitor, then voltage across the capacitor

- a) Leads the current by phase angle  $\pi$  rad.
- b) Leads the current by phase  $\pi/2$  rad.
- c) Lags the current by phase angle  $\pi$  rad.
- d) Lags the current by phase angle  $\pi/2$  rad.

**Ans: d) Lags the current by phase angle  $\pi/2$  rad.**

5) A parallel LC resonant circuit is used as ....

- a) a tuning circuit in a television receiver set.
- b) a transformer
- c) a rectifier

d) a filter circuit.

**Ans: d) a filter circuit**

6) An electric bulb operates 10 V d.c. If this bulb is connected to an a.c. source and gives normal brightness, then peak value of the source is .....

- a) 141.4 V
- b) 14.14 V
- c) 1.414 V
- d) 0.1414 V

**Ans: b) 14.14 V**

7) A coil of resistance  $300\Omega$  and inductance 1.0 H is connected across an alternating voltage of frequency  $\frac{300}{2\pi}$  Hz, therefore phase difference between the voltage and current in the circuit is

- a)  $180^\circ$
- b)  $90^\circ$
- c)  $45^\circ$
- d)  $0^\circ$

**Ans : c)  $45^\circ$**

**Very Short Answer (VSA) ( 1 MARK Each )**

1. Define capacitive reactance.
2. A charged 10 micro farad capacitor is connected to a 81 mH inductor. What is the angular frequency of free oscillations of the circuit? (**Ans:  $1.1 \times 10^3$  rad per sec**)
3. State the equation for impedance Z in an A.C. circuit.
4. In LCR series circuit, what is the condition for current resonance?
5. State any one characteristic of a parallel LC AC resonance circuit.
6. State the expression for an average power consumed over one cycle in the case of a series LCR AC circuit.
7. What is the relation between average current and rms current over half cycle.

**(Ans:  $\frac{2\sqrt{2}}{\pi} i_{rms}$ )**

8. If the peak value of an alternating emf is 15V, what is its mean value over half cycle?

**(Ans: 9.548 V)**

**Short Answer I (SA1) ( 2 MARKS Each )**

1. State the average or mean value of an alternating emf? Obtain the expression for it.

2. Explain term impedance and state the formula for it in the case of an LCR series circuit.
3. State any two characteristics of a series LCR AC resonance circuit.
4. In LCR series circuit, what is the (a) impedance and (b) reactance at current resonance?
5. A series LCR circuit has resistance  $10\Omega$  and reactance is  $7\sqrt{2}\Omega$ . What is the impedance of the circuit? **(Ans: 14.07 $\Omega$ )**
6. A coil of resistance  $10\Omega$  and inductance  $100\text{mH}$  and a capacitor of variable capacitance are connected across a  $20\text{V}, 50\text{Hz}$  A.C. supply. At what capacitance will resonance occur? **(Ans: 318.5 $\mu\text{F}$ )**
7. Find the current in a circuit consisting of a coil and a capacitor in series with an A.C source of  $110\text{V}$  (r.m.s.),  $60\text{Hz}$ . The inductance of a coil is  $0.80\text{H}$  and its resistance is  $50\Omega$ . The capacitance of a capacitor is  $8\mu\text{F}$ . **(Ans:  $I_{rms} = 1.88\text{A}$ )**
8. A  $0.5\mu\text{F}$  capacitor is discharged through a  $10$  millihenry inductor. Find the frequency of discharged. **(Ans:  $2.25 \times 10^3\text{ Hz}$ )**
9. What is the capacitive reactance of a capacitor of  $5\mu\text{F}$  at a frequency (1)  $50\text{ Hz}$  and (2)  $20\text{KHZ}$ ? **(Ans: 636.94 $\Omega$ , 1.59 $\Omega$ )**

#### Short Answer II (SA2) ( 3 MARKS Each )

- 1) State the rms value of an alternating current? Write the relation between the rms value and peak value of an alternating current that varies with time.
- 2) Explain the term inductive reactance. State its unit and dimensions.
- 3) Explain the term capacitive reactance. State its unit and dimensions.
- 4) Define power and obtain an expression for the average power (cover one cycle) in an ac circuit containing a pure (an ideal) resistor.
- 5) Explain the terms sharpness of resonance and Q factor (quality factor).
- 6) What is the inductive reactance of a coil of inductance  $10\text{mH}$  at a frequency (1)  $50\text{Hz}$  (2)  $1000\text{Hz}$  (3)  $20\text{kHz}$ ? **(Ans: 3.14 $\Omega$ , 62.8 $\Omega$ , 1256 $\Omega$ )**
- 7) An alternating emf of  $230\text{V}, 50\text{Hz}$  is connected across a pure ohmic resistance of  $50\Omega$ . Find (1) the current (2) equations for instantaneous values of current and voltage. **(Ans:  $I_{rms} = 4.6\text{A}$ ,  $E_0 = 325.27\text{ V}$ ,  $I_0 = 6.5\text{A}$ ,  $I = 6.5 \sin 100\pi t$ ,  $E = 325.27 \sin 100\pi t$ )**
- 8) A radio can tune over the frequency range of a portion of MW broadcast-band ( $800\text{kHz} - 1200\text{kHz}$ ). If its LC circuit has an effective inductance of  $200\text{mH}$ , what must be the range of its variable condenser? **(Ans: 88pF to 198pF)**

**Long Answer (LA) ( 4 marks Each)**

- 1) Obtain the expression for the applied emf and the effective resistance of the circuit when alternating emf is applied to an LR circuit.
- 2) Obtain the expression for the applied emf and the effective resistance of the circuit when alternating emf is applied to an CR circuit.
- 3) Obtain the expression for the resonant frequency of the LCR series circuit and explain electrical resonance in an LCR series circuit.

SCERTM, PUNE