NAAHAR PUBLIC SCHOOL CBSE SEMNIOR SECONDARY
ACADEMIC YEAR (2022-2023)
MICRO REVISION-6

STD: XII **TOTAL: 30**
SUBJECT: PHYSICS **DATE: 20 .11.2022**

I.ANSWER THE FOLLOWING: **6X1=6**

1. The average value of a cover a complete cycle is:

(a) I_0

(b) $\frac{I_0}{2}$

(c) $\frac{I_0}{\sqrt{2}}$

(d) zero

Answer: (d) zero

2. Which of the following has dimensions different from the rest?
(a) L/R
(b) 1RC
(c) $\sqrt{LC}$
(d) RC
Answer: (b) 1R/C

3. Energy dissipates in LCR circuit in :
(a) L only
(b) C only
(c) R only
(d) All of the above
Answer: (c) R only

4. In series resonant circuit:
(a) reactance is zero
(b) current is zero
(c) voltage is zero
(d) None of these
Answer: (d) None of these

5. In parallel resonant circuit:
(a) impedance is very high
(b) current is very high
(c) voltage is very high
(d) None of these
Answer: (a) impedance is very high

6. Which of the following effects is not shown in alternating current ?
(a) Chemical effect
(b) Magnetic effect
(c) Heating current
(d) All of these
Answer: (a) Chemical effect

II. ANSWER THE FOLLOWING: **2x2=4**

7. a. Define capacitor reactance. Write its SI units.
Answer:
It is the opposition offered to the flow of current by a capacitor. It is measured in ohm.
b. A choke and a bulb are in series to a dc source. The bulb shines brightly.
How does its brightness change when an iron core is inserted inside the choke coil?
Answer:
There is no change in the final brightness as the inductive reactance is zero for dc.

8. a. A light bulb is rated 100W for 220V ac supply of 50Hz. Calculate
(i) The resistance of the bulb;
(ii) The rms current through the bulb.

(i) Given $P = 100W, V_{rms} = 220V, f = 50Hz$

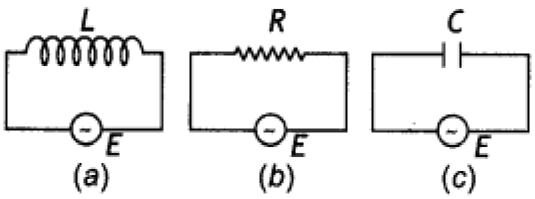
by $P = \frac{V_{rms}^2}{R}$

or $R = \frac{V_{rms}^2}{P} = \frac{220^2}{100} = 484\Omega$

(ii) Now $I_{rms} = \frac{V_{rms}}{R} = \frac{220}{484} = 0.45A$

III. ANSWER THE FOLLOWING: 2X3=6

9. a. Figure (a), (b), and (c) show three ac circuits in which equal currents are flowing. If the frequency of emf be increased, how will the current be affected in these circuits? Give the reason for your answer.



Answer:

There will be no change in the current in figure (b) as the resistance of the resistor does not depend upon the frequency of the applied ac.

The reactance of the inductor in figure (a) is given by $X_L = 2\pi f L$. An increase in frequency increases the value of inductive reactance. This decreases the current through the circuit.

The reactance of the capacitor in figure (c) is given by $X_C = 1\omega C=12\pi fC$. An increase in frequency decreases the value of capacitive reactance. This increases the current through the circuit.

b. Find the inductance of the Inductor that would have a reactance of 50 ohm when used with an ac source of frequency $25/\pi$ kHz.

Answer:

Using $X_L = 2\pi f L$ or $L = XL/2\pi f$, therefore

$L = 50\times\pi/2\pi\times25 = 1$ H

10. A 15.0 μF capacitor is connected to a 220V, 50Hz source. Find the capacitive reactance and the current (rms and peak) in the circuit. If the frequency is doubled, when happens to the capacitive reactance and the current?

Given : $C = 15 \times 10^{-6}$ F

Rms value of voltage $V_{rms} = 220$ V

Frequency of source $f = 50$ Hz

Capacitive reactance $X_C = \frac{1}{2\pi fC} = \frac{1}{2\pi \times 50 \times 15 \times 10^{-6}} = 212.3\Omega$

Rms value of current $I_{rms} = \frac{V_{rms}}{X_C} = \frac{220}{212.3} = 1.04$ A

Peak value of current $I_o = \sqrt{2}I_{rms} = \sqrt{2} \times 1.04 = 1.465$ A

Since $X_C \propto \frac{1}{f}$

So capacitive reactance gets halved if the frequency is doubled.

Also, $I_{rms} \propto \frac{1}{X_C} \propto f$

Socurrent becomes doubled if the frequency is doubled.

IV. ANSWER THE FOLLOWING: 2X5=10

11. Discuss LCR circuit with phaser diagram.

Answer:

LCR circuit with phaser diagram : In this circuit inductance of coil (L), capacitance (C) and electric resistance (R) are connected in series. If strength of current in circuit is I then p.d. across R is V_R. Which is in phase of current? But in inductor, induced p.d. is ahead of current by phase $\pi/2$ In case of capacitor p.d. V_c across C is lagging behind in phase by $\pi/2$ with current. So phase difference between V_L & V_c is 180°.

. Then its value is $V_L - V_C$. The phase difference with V_R is $\pi/2$.

Now p.d. in L-C-R Curcuit is $V^2 = V^2_R + (V_L - V_C)^2$.

Since $V_R = IR$, $V_L = IX_L$, $V_C = IX_C$

Here, $X_L \rightarrow$ inductive reactance & $X_C \rightarrow$ capacitive reactance. So, $V^2 = I^2R^2 + (IX_L - IX_C)^2$

. or, $\frac{V^2}{I^2} = R^2(X_L - X_c)^2$ $or, \frac{V}{I} = \sqrt{R^2 + (X_L - X_C)^2}$ . .

Here, $\frac{V}{I} = Z \rightarrow$ imedance of the circuit

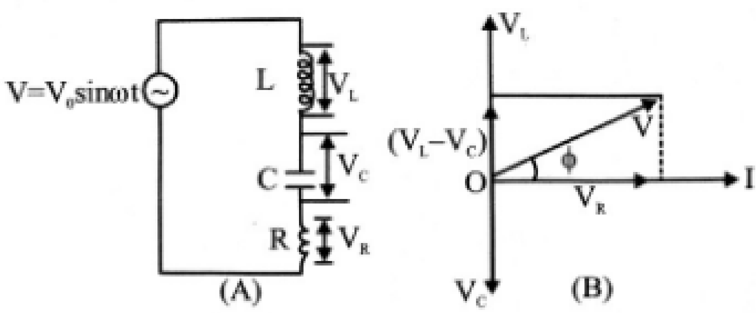
So, $Z = \sqrt{R^2 + (X_L - X_c)^2}$

Since $X_L = \omega_L$ & $X_c = \frac{1}{\omega_c}$

$\therefore Z = \sqrt{R^2 + \left(\omega_L - \frac{1}{\omega_c}\right)^2}$

If phase diff. between V & I is ϕ, then

$$\tan\phi = \frac{V_L - V_c}{V_R} = \frac{I(X_L - X_c)}{IR} = \frac{\left(\omega_L - \frac{1}{\omega_c}\right)}{R}$$



So, here it is clear that the value of φ depends upon relative value of R, X_L & X_C. In case of resonance $\rightarrow$ $X_L = X_C$ and $\tan\varphi = O$ i.e., V & I will be in same phase. In this situation Z = R. In this condition value of current is the maximum. this is called electrical resonance.

Resonant frequency, $\boxed{f = \frac{1}{2\pi}\sqrt{\frac{1}{LC}}}$

12. a. A 44 mH inductor is connected to 220 V, 50 Hz ac supply. Determine the rms value of the current in the circuit.

We know that $X_L = \omega L = 2\pi fL = 2 \times 3.14 \times 50 \times 44 \times 10^{-3} = 13.82\Omega$

Therefore, $I_{rms} = \frac{E}{X_L} = \frac{220}{13.82} = 15.92A$

b. A 60μF capacitor is connected to a 110 V, 60 Hz ac supply. Determine the rms value of the current in the circuit.

Given: The capacitance of the capacitor is 60μF.

The RMS value of the voltage supplied is 110V.

The frequency of the AC supply is 60Hz.

To find: The RMS value of the current.

We know that the impedance of the capacitor is determined by:

$$X_C = \frac{1}{\omega C}$$

$$= \frac{1}{2\pi f C}$$

$$\Rightarrow \frac{1}{2 \times 3.14 \times 60 \times 60 \times 10^{-6}}$$

$$\Rightarrow 44.2\Omega$$

The RMS value of the current is obtained as

$$I_{rms} = \frac{E}{X_C}$$

$$\Rightarrow \frac{110}{44.2}$$

$$\Rightarrow 2.49 \text{ A}$$

V. CASE BASED QUESTIONS **4X1=4**

13. An LC circuit also called a resonant circuit, tank circuit or tuned circuit is an electric circuit consisting of an inductor represented by the letter L and a capacitor, represented by the letter C connected together. An LC circuit is an idealized model since it assumes there is no dissipation of energy due to resistance. An LC circuit contains a 20 mH inductor and a 50μF50μF capacitor with an initial charge of 10 mC The resistance of the circuit is negligible. Let the instant the circuit is closed be t = 0.

(i) The total energy stored initially is

(a) 5 J (b) 3 J (c) 10 J (d) 1 J

(ii) The natural frequency of the circuit is

(a) 159.24 Hz (b) 200.12 Hz (c) 110.25 Hz

(d) 95 Hz

(iii) At what time is the energy stored completely electrical?

(a) $T, 5T, 9T$ (b) $\frac{T}{2}, \frac{5T}{2}, \frac{9T}{2}$ (c) 0, T, 2T, 3T (d) $0, \frac{T}{2}, T, \frac{3T}{2}$

(iv) At what time is the energy stored completely magnetic?

(a) $\frac{T}{2}, \frac{3T}{2}, \frac{T}{4}$ (b) $\frac{T}{3}, \frac{T}{9}, \frac{T}{12}$ (c) 0, 2T, 3T (d) $\frac{T}{4}, \frac{3T}{4}, \frac{5T}{4}$

(v) The value of X_L is

(a) 20Ω (b) 40Ω (c) 60Ω (d) 50Ω

Answers:

$$\Rightarrow \quad X_L = 20\Omega$$

(i) (d): Resistance of the two wire lines carrying power $= 0.5\Omega/\text{km}$

Total resistance $= (15 + 15)0.5 = 15\Omega$

(ii) (c): Line power loss = I^2R

RMS current in the coil,

$I = \frac{P}{V_1} = \frac{800 \times 10^3}{4000} = 200 \text{ A}$

$\therefore$ Power loss $= (200)^2 \times 15 = 600 \text{ kW}$

(iii) (d): Assuming that the power loss is negligible due to the leakage of the current.

The total power supplied by the plant

= 800 kW + 600 kW = 1400 kW

(iv) (b): Voltage drop in the power line = IR

= 200 x 15 = 3000 V

(v) (d): Total voltage transmitted from the plant = 3000 V + 4000 V = 7000 V