

# SHORT QUESTIONS

**16.1** A sinusoidal current has rms (effective) value of 10 A. What is the maximum or peak value?

**Ans.** Root mean square value of sinusoidal current

$$I_{\text{rms}} = 10\text{A}$$

Using

$$I_{\text{rms}} = \frac{I_0}{\sqrt{2}}$$

$$\begin{aligned} I_0 &= I_{\text{rms}} \times \sqrt{2} \\ &= 10 \times \sqrt{2} \\ &= 10 \times 1.414 = 14.14 \text{ A} \end{aligned}$$

So peak value of current =  $I_0 = 14.14 \text{ A}$

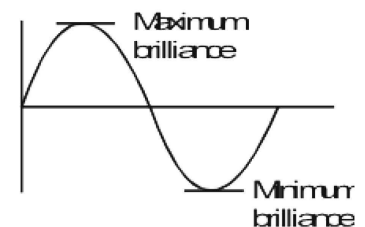
**16.2** Name the device that will (a) permit flow of direct current but oppose the flow of alternating current (b) permit flow of alternating current but not the direct current.

- Ans.** (a) A device that will permit flow of direct current but opposes the flow of alternating current is called an inductor.  
 (b) A device that will permit the flow of alternating current (A.C) and not the direct current is called a capacitor.

**16.3** How many times per second will an incandescent lamp reach maximum brilliance when connected to a 50 Hz source?

**Ans.** The lamp will reach maximum brilliance 100 times per second, because current becomes maximum twice in a cycle. As frequency of A.C is 50 Hz. i.e., 50 Cps.

Maximum brilliance =  $2 \times 50 = 100$  times per second



**16.4** A circuit contains an iron-cored inductor, a switch and a D.C. source arranged in series. The switch is closed and after an interval reopened. Explain why a spark jumps across the switch contacts?

**Ans.** Consider a circuit contains an iron-cored inductor, a switch and a D.C source connected in series. When switch is closed, then current flows through the inductor and energy is stored in it in the form of magnetic field. When a switch is reopened then energy stored flows as a high current through the switch and a spark jumps across the switch contacts.

**16.5** How does doubling the frequency affect the reactance of (a) an inductor (b) a capacitor?

**Ans.** (a) **For an Inductor:** The formula for the reactance of an inductor is given by

$$X_L = \omega L \quad \text{But} \quad \omega = 2\pi f$$

$$\text{So} \quad X_L = 2\pi fL$$

Let  $X'_L$  be the reactance of an inductor when frequency becomes double i.e.,  $2f$ .

$$X'_L = 2\pi(2f)L$$

$$X'_L = 2(2\pi fL)$$

$$X'_L = 2X_L$$

Hence by doubling the frequency, the inductor's reactance will become double.

(b) For capacitor, the formula for reactance of the capacitor is given by

$$X_C = \frac{1}{\omega C} \quad \text{But } \omega = 2\pi f$$

$$X_C = \frac{1}{2\pi fC}$$

Let  $X'_C$  be the reactance of the capacitor when frequency becomes double i.e.,  $2f$ .

$$\text{So } X'_C = \frac{1}{2\pi(2f)C}$$

$$X'_C = \frac{1}{2(2\pi fC)}$$

$$X'_C = \frac{X_C}{2}$$

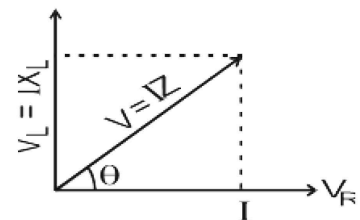
Hence by doubling the frequency, reactance of a capacitor becomes half.

**16.6 In a R-L circuit, will the current lag or lead the voltage? Illustrate your answer by a vector diagram.**

**Ans.** In R-L series circuit the current will lag the voltage by an angle  $\theta$

$$\theta = \tan^{-1} \left( \frac{\omega L}{R} \right)$$

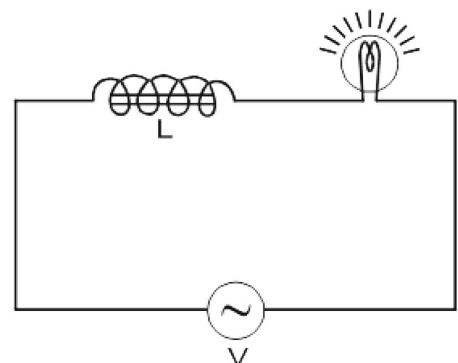
$$\theta = \tan^{-1} \left( \frac{X_L}{R} \right)$$



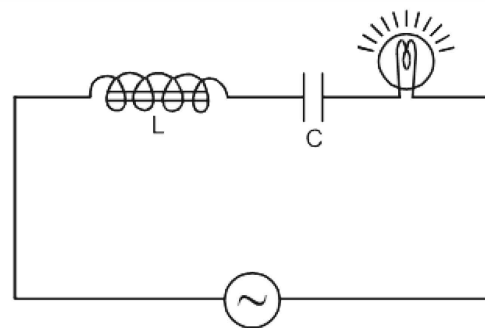
**16.7 A choke coil placed in series with an electric lamp in an A.C. circuit causes the lamp to become dim. Why is it so? A variable capacitor added in series in this circuit may be adjusted until the lamp glows with normal brilliance. Explain, how this is possible?**

**Ans.** Consider a circuit in which a choke coil is placed in series with an electric lamp in an A.C circuit as shown in figure. We know that reactance of an inductor is  $X_L = 2\pi fL$  and in this case total impedance of circuit will be

$$Z = \sqrt{X_L^2 + R^2}$$

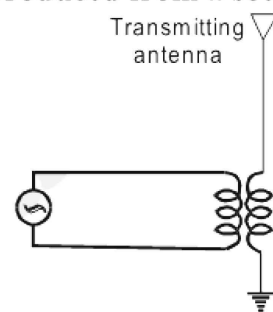


As choke coil has very large reactance therefore current in circuit will be very small and lamp will become dim but when a variable capacitor is added in series with this circuit as shown in figure then at resonance frequency reactance of capacitor will become equal to the reactance of an inductor and total impedance of circuit will become minimum that is equal to 'R' therefore current will become maximum. So bulb will glow with normal brilliance.



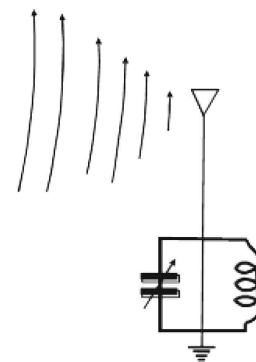
**16.8 Explain the conditions under which electromagnetic waves are produced from a source?**

**Ans.** Electromagnetic waves can be produced by changing electric or magnetic field or by accelerating the charge particles or oscillating the charge particles by connecting it to an alternating voltage source. Radio transmitting antenna provides a good example of generating electromagnetic waves by acceleration of charges. It is charged by an alternating source of potential of frequency  $f$  and time period  $T$ . As the changing potential alternates the charges will be changes from  $+q$  to  $-q$  after regular time intervals this will change electric flux and it will sets up electromagnetic waves.



**16.9 How the reception of a particular radio station is selected on your radio set?**

**Ans.** The receiving antenna is used for reception of a particular radio station is selected in our radio set. Receiving antenna consist of inductor and a variable capacitor connected parallel which is called  $L - C$  circuit and its frequency is given by  $f = \frac{1}{2\pi\sqrt{LC}}$  when frequency of electromagnetic waves match with the frequency of  $L - C$  circuit then due to resonance circuit will be tuned.



**16.10 What is meant by A.M. and F.M.?**

**Ans. (i) A.M:** The term A.M stands for amplitude modulation. A type of modulation in which amplitude of the carrier wave is increased or decreased as the amplitude of the superposing modulating signal increases or decreases. The A.M transmission frequencies range from 540 KHz to 1600 KHz. The sound quality of A.M is not good.

**(ii) F.M:** The term F.M stands for frequency modulation. A type of modulation in which frequency of carrier waves have increased or decreased as the modulating signal amplitude increases or decreases but the carrier wave amplitude remains constant. The F.M transmission frequencies range from 88 MHz to 108 MHz. F.M radio waves are less affected by electrical interference therefore they provide high quality transmission of sound.

