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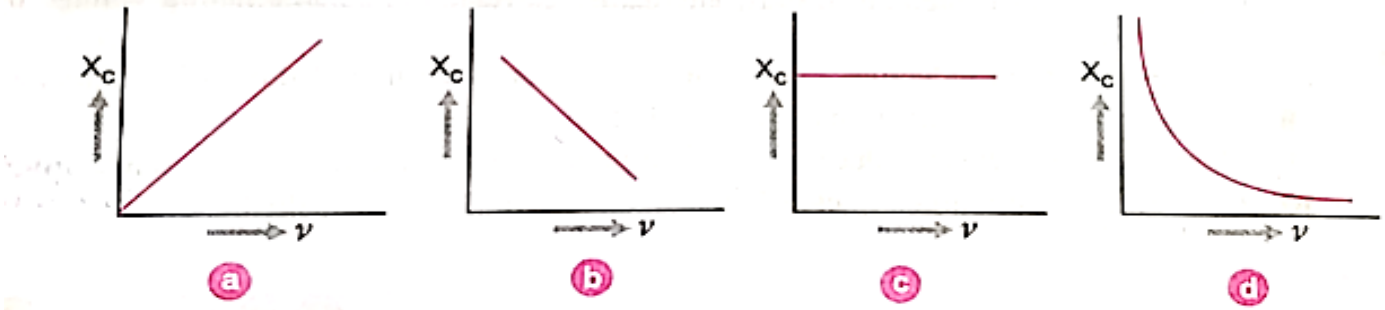
| | **INDIAN SCHOOL AL WADI AL KABIR** | |
| **Class: XII** | **Department: SCIENCE 2021 -22**<br>**SUBJECT: PHYSICS** | **Date of submission:**<br>**04.09.2021** |
| **Worksheet No:07**<br>**WITH ANSWERS** | **Topic: Alternating Current** | **Note:**<br>**A4 FILE FORMAT** |

**Directions (Q. No. 1-15): Select the most appropriate option from these given below each question.**

**1. The variation of reactance of a capacitor with frequency is represented correctly by**




**2. Choose the quantity whose SI unit is not ohm.**

(*a*) Resistance (*b*) Reactance (*c*) Capacitance (*d*) Impedance

**3. Which of the following does not have the dimensions of time ?**

(*a*) $RC$ (*b*) $\frac{L}{R}$ (*c*) $\frac{R}{L}$ (*d*) $\sqrt{LC}$

**4. The peak value of 220 V a.c. is**

(*a*) 220 V (*b*) $\frac{220}{\sqrt{2}}$ V (*c*) 440 V (*d*) $220\sqrt{2}$ V

5. **Phase difference between voltages across $L$ and $C$ in series is**

(a) 0° (b) 90° (c) 180° (d) 360°

6. **The resistance of a coil for direct current is 10 ohm. When a.c. is sent through the same coil, its resistance would be**

(a) 10 Ω (b) > 10 ohm (c) < 10 ohm (d) cannot say

7. **The average value of a.c. voltage $E = E_0 \sin \omega t$ over the time interval $t = 0$ to $t = \pi/\omega$ is**

(a) $-2E_0/\pi$ (b) $E_0/\pi$ (c) $\frac{2E_0}{\pi}$ (d) zero

8. **The alternating current from a source is represented by $I = 0{\cdot}5 \sin 314\ t$. The frequency of a.c. is**

(a) 314 Hz (b) 100 Hz (c) 50 Hz (d) zero

9. **Q factor of resonance is given by**

(a) $\frac{1}{R}\sqrt{\frac{L}{C}}$ (b) $\frac{1}{R}\sqrt{\frac{C}{L}}$ (c) $\frac{1}{L}\sqrt{\frac{R}{C}}$ (d) $\frac{1}{C}\sqrt{\frac{L}{R}}$

10. **The power factor of an a.c. circuit is given by $\cos\phi =$**

(a) $\frac{R}{Z}$ (b) $\frac{Z}{R}$ (c) $\frac{R}{X_L}$ (d) $\frac{R}{X_C}$

11. In a series LCR circuit, resonant frequency depends on

(a) $\frac{L}{C}$ (b) $\frac{1}{\sqrt{LC}}$ (c) $\sqrt{LC}$ (d) $\sqrt{\frac{L}{C}}$

12. For an LCR circuit, the power transfer from the driving source to the driving oscillator is $P = I^2 Z\cos\phi$. Which of the following is incorrect?

(a) Here, the power factor $\cos\phi \geq 0$, $P = \geq 0$.

(b) The driving force can give no energy to the oscillator (P = 0) in some cases.

(c) The driving force cannot syphon out(P<0) the energy out of oscillator.

(d) The driving force can take away energy out of the oscillator.

13. Choose the correct statement

(a) A capacitor can conduct a dc circuit but not an inductor.

(b) In a dc circuit the inductor can conduct but not a capacitor.

(c) In ac circuit both the inductor and capacitor cannot conduct.

(d) The inductor has infinite resistance in a dc circuit.

14. A coil of self-inductance 'L' is connected in series with a bulb B and an ac source. Brightness of the bulb decreases when

(a) frequency of the ac source is decreased.

(b) number of turns in the coil is reduced.

(c) the capacitance of reactance $X_C = X_L$ in included.
(d) an iron rod is inserted in the coil.

15. The reactance of the capacitor C is X. If both the frequency and capacitance be doubled, then new reactance will be

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

**Fill in the blanks with appropriate words.**

1. The.....of alternating current varies.....with time and its..... is reversed..... .
2. Ordinary d.c. ammeter and d.c. voltmeter, when used in.....record.....reading.
3. The r.m.s. value or.....value or.....value of a.c. is.....the peak value of a.c.
4. 220 V a.c. means..... And an a.c. of 1 A means..... .
5. In an a.c. circuit containing *R* only.....and.....are in.....phase.
6. In an a.c. circuit containing *L* only, alternating current.....alternating voltage by a phase angle of..... .
7. The dimensions of inductive.....and.....are the same as those of..... .
8. A condenser.....a.c. to pass through but.....d.c.
9. Ohmic resistance *R* can reduce.....but inductor *L* can reduce.....only.
10. A series resonance circuit is called an.....and a.....is called..... .

ANSWERS OF MCQs; -1. (d),2. (c), 3. (c), 4. (d), 5. (c), 6. (b), 7. (c), 8. (c), 9. (a), 10. (a), 11. (b), 12. (a), 13. (b), 14. (a), 15. (d),

ANSWERS OF fill in the blanks: -

1.magnitude; continuously; direction; periodically.
2.a.c., circuit; zero
3.virtual; effective; 0.707 times
4.Ev = 220; Iv = 1A.
5.ac; av; same
6.lags behind; 90
7.reactance; capacitive reactance; resistance.
8.allows; blocks
9.both a.c. and d.c.; a.c
10. acceptor circuit; parallel resonance circuit; rejector/ filter,

.

NUMERICALS: -

1. A circuit is set up by connecting inductance L= 100 mH, resistor R = 100 Ω, and capacitor of reactance 200 Ω in series. An alternating emf $150\sqrt{2}$ V, 500/π Hz is applied across this series combination. Calculate the power dissipated in the resistor.

HINTS: - $Z = \sqrt{(XL)2 + R2} = 100\sqrt{2}$ ohm.

$I = 1.5A$

$P = I^2R = 225W.$

2. In India domestic power supply is a 220 V, 50 Hz; while in USA it is 110 V, 50 Hz. Give one advantage and one disadvantage of 220 V supply over 110 V supply.

HINTS: - For transfer of power (=V×I) at higher voltage (220 V instead of 110 V), current carried by wires is just half. Therefore, such wires need not be very thick, saving lot of transmission material and reducing the cost of transmission. This is one advantage of 220 V supply.

But to design a device of particular wattage,

$P=V^2R$, $P=V^2R$ as $V^2$ is 4 times, R must be four times.

If not, the dissipation or power in the form of heat will be larger on 220 V supply. This is one disadvantage of this supply.

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

HINTS: - find impedance, and then, I = V/Z.

4. Determine the current quality factor at resonance for a series LCR circuit with L = 1.00 mH, C = 1.00 nF and R = 100 Ω connected to an AC source having peak voltage of 100 V.

HINTS: - $Q = \frac{1}{R}\sqrt{\frac{L}{C}} = 10.$

5. A series LCR circuit is connected to an ac source (200 V, 50 Hz). The voltage across the resistor, capacitor and inductor are respectively 200 V, 250 V and 250 V. (i) The algebraic sum of voltages across the three elements is greater than the voltage of the source. How is this paradox resolved?

(ii) Given the value of resistor of R = 40 Ω, calculate the current in the circuit.

HINTS: - (i) voltage drop at inductor is equal and opposite to that of voltage drop at capacitor. Also, by using phasor diagram.
(ii) I = V/R = 5A.

6. (i) An alternating voltage given by V = 140 sin314t is connected across a pure resistor of 50 Ω. Find (a) the frequency of the source. (b) the rms current through the resistor.

(ii) How much current is drawn by the primary coil of a transformer which steps down 220 V to 22 V to operate a device with an impedance of 220 Ω?

HINTS: - (i)(a) 100 Hz (b) 2A,
(ii) current drawn in secondary coil IS = 22/220 = 0.1 A.
Power in primary = power in secondary
$V_s I_s = V_p I_p$
$I_s = V_p I_p / V_s = 0.001A.$

short answers type questions: -

1. Show that the current leads the voltage in phase by π/2 in ac circuit containing an ideal capacitor.

Hints: - refer to note book.

2. In a series LCR circuit, obtain the conditions under which (i) the impedance of the circuit is minimum, and (ii) wattless current flows in the circuit.

Hints: - refer to note book.

3.Can a capacitor be used instead of a choke coil for controlling a.c.?

Hints: - A choke coil is a device that reduces current in the circuit without power dissipation. A capacitor is a device for which the average power dissipation over one full cycle of ac is zero. Hence, a capacitor can be used as a choke coil.

4. What is meant by back emf in a motor?

Hints: -it is the emf induced in the coil of a motor as it rotates in the magnetic field. It opposes the rotation of the coil in magnetic field.

5. What is the use of a motor starter?

Hints: - A motor starter is a variable resistance. When the motor is switched on, the starter offers maximum resistance so that a small current flow through the motor coil in the absence of back emf. This prevents damage to the motor when it is switched on.

Long answers type questions: -

1. (i) What is impedance?

(ii) A series LCR circuit is connected to an ac source having voltage $V = V_{\circ}\sin\omega t$. Derive expression for the impedance, instantaneous current and its phase relationship to the applied voltage. Find the expression for resonant frequency.

Hints: - refer to notebook.

2.Describe briefly with the help of a labelled diagram the basic elements of an ac generator.

Hints: - refer to notebook.

3.State its underlying principle.

Show diagrammatically how an alternating emf is generated by a loop of wire rotating in a magnetic field.

Write the expression for the instantaneous value of the emf induced in the rotating loop.

Hints: - refer to notebook.

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