PHYSICS

BOOKS - BETTER CHOICE PUBLICATION

ALTERNATING CURRENTS

Very Short Answertype Questions

1. Define power factor.

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2. What do you mean by wattless current?

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3. Why high frequency current can pass easily through a capacitor ?

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4. Prove that high frequency a.c. cannot pass through a pure inductor, but can pass through

a pure capacitor.

5. What do you mean by impedance of a circuit?

6. What is the relation between peak value and root mean square value of alternating emf ?

7. What is the phase relationship between current and voltage in an inductor?

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8. What do you mean by power factor of an ac circuit ?

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9. Define inductive reactance of an inductor.

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10. Define the capacitive reactance of a capacitor.

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11. What is an idle current ?

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12. What is the impedance of a circuit ?

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13. Define resonant frequency of LCR series circuit.

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Short Answertype Questions

1. Discuss the behaviour of an inductor in d.c. and high frequency a.c. circuits.

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2. Discuss the behaviour of an inductor in d.c. and high frequency a.c. circuits.

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3. Can a.c. be used for electrolysis? Why?

4. Can one have inductance without a resistance ? How about a resistance without an inductance?

5. Which is more dangerous in use a.c. or d.c.? Explain, why?

6. The frequency of a.c. is doubled, what happens to inductive reactance?

7. What is the capacitive reactance of a capacitor used in a circuit having d.c. e.m.f.? Explain.

8. Discuss the behaviour of an inductor in d.c. and high frequency a.c. circuits.

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9. An alternating e.m.f. is supplied to a pure resistance investigate the phase relationship between current flowing through it and the applied e.m.f.

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10. An alternating e.m.f. is supplied to a pure resistance investigate the phase relationship between current flowing through it and the applied e.m.f.

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11. An alternating e.m.f. is supplied to a pure inductor investigate the phase relationship between current flowing through it and the applied e.m.f.

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12. Find a phase relation between current and voltage in an a.c. circuit containing a pure inductor. Why high frequency current can not passthrough a pure inductor easily ?

13. Show mathematically that in an a.c. circuit containing only inductance, the current lags behind the e.m.f. by a phase of $\dfrac{\pi}{2}$.

An a.c. voltage $E = E_0 \sin \omega t$ is applied across

an inductor L. Obtain an expression for current I.

14. An alternate e.m.f. is applied to pure capacitance. Investigate the phase relationship between the current flowing through it and e.m.f. applied.

15. Finda phase relation between current and voltage in an a.c. circuit containing a pure capacitance. A pure capacitor blocks directcurrent, why ?

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16. Define terminal velocity and find an expression for it.

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17. Derive the relation for mean value of alternating current.

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18. Define mean value of an alternating current.

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19. What is root mean square value of alternating current? Derive a relation between peak value and virtual value of alternating current.

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20. Prove mathematically that the average power over a complete cycle of alternating current through an ideal inductor is zero.

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21. Prove mathematically that the average power over a complete cycle of alternating current through an ideal inductor is zero.

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22. Define impedance of an electric circuit. How it differs from ohmic resistance ? Find an expression for the impedance of an a.c. circuit containing L-C-R in series.

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23. Derive an expression for impedance of an a.c. circuit with an induct L, capacitor C and a resistor R in series. What is condition of resonance?

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24. With the help of phasor diagram derive an expression for impedance in LCR circuit.

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25. With the help of phasor diagram derive an expression for impedance in LCR circuit.

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26. Derive an expression for average power of an AC (alternating current) circuit.

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27. What is meant by average value of alternating current? Obtain an expression for it. Prove that the average value of alternating current over one complete cycle is zero.

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Long Answertype Questions

1. Obtain an expression for the power in a.c. circuit containing a resistance and capacitance

in series.

2. Define impedance of an electric circuit. How it differs from ohmic resistance ? Find an expression for the impedance of an a.c. circuit containing L-C-R in series.

3. Obtain an expression for the power in a.c. circuit containing a resistance and capacitance in series.

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4. What is meant by average value of alternating current? Obtain an expression for it. Prove that the average value of alternating current over one complete cycle is zero.

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5. Define root mean square value of an alternating current.

6. A voltage $V = V_0 \sin \omega t$ is applied to a series LCR-circuit. Derive the expression for the average power dissipated over a cycle. Under what condition no power is dissipated even though the current flows through the circuit.

7. What is difference between ohmic resistance

and impedance of an a.c. circuit.

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8. What is a sereis resonant circuit? Derive an

expression for resonance frequency.

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9. Derive an expression for impedance of an a.c. circuit with an induct L, capacitor C and a resistor R in series. What is condition of resonance?

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10. Define resonant frequency of LCR series circuit.

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11. Define impedance of an electric circuit. How it differs from ohmic resistance ? Find an expression for the impedance of an a.c. circuit containing L-C-R in series.

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12. Find a phase relation between current and voltage in an a.c. circuit containing a pure inductor. Why high frequency current can not passthrough a pure inductor easily ?

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13. Finda phase relation between current and voltage in an a.c. circuit containing a pure capacitance. A pure capacitor blocks directcurrent, why ?

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14. What is meant by mean or average value of alternating current ? Show that mean value of ac over a complete cycle is zero.

Numericals Problems

1. At what frequency a coil of 1 mH will have a reactance of 3142Ω What is the capacity of capacitor, which has the same reactance of the same frequency ?

2. An electric device, which runs at 80 volt d.c. and consumes 10 A current , is connected to 100 vol-50 Hz a.c. supply through a choke. Calculate the inducance of the choke coil for the safe working of the device.

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3. A capacitor, a 15Ω resistor and 101.5 mH inductor are placed in series with 50 Hz. AC source. Calculate the capacitance of the

capacitor, if the current is observed in phase with the voltage.

4. A coil of inductance 0.50 H and resistance 100Ω is connected to a 240 V, 50 Hz ac supply. What is the maximum current in the coil?

5. A coil of inductance 0:2 Henry and olmic resistance 40 ohm is connected to 300 V, 50 Hz a.c. supply. Find the maximum current in coil.

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6. A coil of inductance 0.50 H and resistance 100Ω is connected to a 240 V, 50 Hz ac supply. What is the maximum current in the coil?

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7. The instantaneous current from a.c. source is I = sin 314 t. What is the peak value of current?

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8. What is the peak value of 220 V ac ?

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9. A 200 V varialbe frequency a.c. source is connected to a series combination the $L = 5H, C = 80\mu F$ and $R = 40\Omega$. Calculate the angular frequency of the soucre to get maximum current in the cicuit, the current amplitude at resonance and power dissipated in the circuit.

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10. A circuit consists of a noninductive resistor of 50Ω, a coil of inductance 0.3 H and resistance 2Ω, and a capacitor of $40\mu F$ in series and is supplied with 200 volt rms at 50 cycles / sec.

11. A 40Ω resistor, 3m H inductor and $2\mu F$ capacitor are connected in series to 110V, 5000

Hz AC source.Calculate Impedenceof the circuit and value of current in the circuit.

12. When an inductor L and a resistor R in series are connected across a 12V, 50Hz supply of current of 0.5 A flows in a circuit. The current differs in phase from applied voltage to $\frac{\pi}{3}$ radins calculate the value of R.

13. A circuit consists of a resistance 10 ohm and a capacitance $0.1\mu F$. If an alternating e.m.f. of 100V, 50Hz is applied, calculate the current in the circuit.

14. In a series RC circuit, R = 30 ohm, C = $0.25\mu F$, V = 100 V, $\omega = 10000 rad/s$. Find the current in the circuit and calculate the voltage across the resistor and capacitor. Is the

algebraic sum of these voltages more than the source voltage ? If yes, resolve the paradox.

15. A capacitor of capacitance $100\mu F$ and a coil of resistance 50Ω and inductance 0.5 H are connected in series with a 110 V, 50 Hz AC source. Find the rms value of the current.

16. An a.c. source of 200 V, 50 Hz is connected across a 300Ω resistor and capacitor of $\dfrac{25}{\pi}\mu F$ in series. Calculate (a) reactance (b) impedance (c) current in the circuit.

17. An a.c. source of 200 V , 50 Hz is connected across a 400 ohm resistor and an inductor of 3 H in series. Calculate impedance.

18. A capacitor of capacitance $100\mu F$ and a coil of resistance 50Ω and inductance 0.5 H are connected in series with a 110 V, 50 Hz AC source. Find the rms value of the current.

19. A series circuit with L = 0.12H, C = 0.48 mF and R = 25 ohm, is connected to a 220V variable frequency power supply. At what frequency is the circuit current maximum ?

20. A capacitor of unknown value and an inductor of 0.1H and a resistor of 10Ω are connectedin series to a 220V, 50Hz ac source. It is foundthat the power factor of circuit is unity.Calculate the capacitance of capacitor and maximum amplitude of current

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Most Expected Questions

1. What is a phasor?

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2. In a series LCR-circuit, what is the value of power factor at resonacne?

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3. Why do d.c. voltmeter and d.c. ammeter cannot read a.c.?

4. When are the voltage and current in LCR circuit in LCR- circuit in same phase?

5. Why do d.c. voltmeter and d.c. ammeter cannot read a.c.?

6. Peak value of an a.c. source is E_0. What is its r.m.s. value?

7. The division marked on the scale of an a.c. ammeter is not equally spaced. Why?

8. What do you mean by the admittance of LCR-circuit?

9. A coil and an electric bulb are connected in series with an ac. Source. On introducing a soft iron bar inside the coil, the intensity of the bulb will

10. An electric lamp is connected in series with a variable capacitor. What happens if source is D.C. ?

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11. An ideal inductor when connected in a.c. circuit does not produce heating effect yet reduces the current in the circuit. Explain why?

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