PHYSICS

BOOKS - OSWAAL PUBLICATION PHYSICS (KANNADA ENGLISH)

ALTERNATING CURRENT

Topic 1 Very Short Answer Type Questions

1. State which of the two, the capacitor or an inductor, tends to become SHORT when the frequency of the applied alternating voltage has a high value.

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2. Define the term 'rms value of the current'. How is it related to the peak value ?

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Topic 1 Short Answer Type Questions I

1. Name two advantages of alternating current.

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2. Name two advantages of alternating current.

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3. How does current in a pure capacitor vary in terms of phase angle with the voltage across it?

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4. An alternating voltage given by V =140 sin 314 t is connected across a pure resistor of 50Ω find :

(i) the frequency of the source.

(ii) The rms current through the resistor.

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5. The graphs (i) and (ii) represent the variation of the opposition offered by the circuit element to the flow of alternating current with frequency of the applied emf. Identify the circuit element

corresponding to each graph.

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6. An electric lamp having a coil of negligible inductance connected in series with a capacitor and an a.c. source is glowing with certain brightness. how does the brightness of the lamp change on reducing (i) the capacitance, and (ii) the frequency ? Justify your answer.

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Topic 1 Long Answer Type Questions

1. Draw phasor diagram for the ac circuit comprising of a pure inductor.

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Topic 1 Numerical Problem

1. A pure inductor of 25.0 mH is connected to a source of 220 V. Find the inductive reactance and rms current in the circuit if the frequency of the source is 50 Hz.

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Topic 2 Very Short Answer Type Questions

1. Write the condition for .resonance. of series LCR circuit.

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2. What is wattless current?

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3. How much average power over complete cycle does an a.c. source supplied to a capacitor?

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4. Why is choke coil needed in the use of fluorescent tubes with ac mains? Why can we not use an ordinary resistor instead of the choke coil?

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Topic 2 Short Answer Type Questions I

1. The figure shows a series LCR circuit connected to a variable frequency of 220 V source with L = 50 mH, $C = 80\mu F$ and $R = 40\Omega$.

(i) The source frequency which drives the circuit in resonance,

(ii) the quality factor Q of the circuit.

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2. A capacitor 'C', a variable resistor 'R' and a bulb 'B' are connected in series to the a.c. mains in circuit as shown. The bulb glows with some brightness. How will the glow of the bulb change if (i) a dielectric slab is introduced between the plates of the capacitor keeping resistance R to be the same, (ii) the resistance R is increased keeping the same capacitance ?

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3. 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.

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Topic 2 Short Answer Type Questions Ii

1. Show that voltage in an inductor leads the current by $\pi / 2$ rad for a pure inductor

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2. What is meant by resonance in a series LCR circuit? Write the expression for the current through LCR series circuit at resonance. Mention any one application of resonant circuits.

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3. Find the value of the phase lag/lead between the current and voltage in the given series LCR circuit. Without making any other change, find the value of the additional capacitor, such that when suitably joined to the capacitor $(C = 2\mu F)$ as shown. What would make the power factor of the circuit as unity ?

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4. 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 is (i) no power dissipated even though the current flows through the circuit, maximum power dissipated in the circuit ?

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5. How much average power over complete cycle does an a.c. source supplied to a capacitor?

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6. A lamp is connected in series with a capacitor. Predict your observations for dc and ac connections. What happens in each case if the capacitance of the capacitor is reduced?

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7. A series LCR circuit is connected to an AC source of voltage v and angular frequency Ω. When only the capacitor is removed the current lags behind the voltage by a phase angle $'\phi'$ and when only the inductor is removed the current leads the voltage by the same phase angle. Find the current flowing and the average power dissipated in the LCR circuit.

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Topic 2 Long Answer Type Questions

1. A series LCR circuit is connected to an a.c. source of variable frequency. Drow a suitable phasor diagram deduce the expressions for the amplitude of the current and phase angle.

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2. Obtain the condition at resonance draw a plot showing the variation of current with the frequency of a.c. source for two resistances and R_1 and $R_2(R_1 > R_2)$. Hence define the quality factor Q and write its role in the tuning of the circuit.

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3. Derive an expression for the impedance of a series LCR circuit connected to an a.c. supplied to the of variable frequency.

Plot a graph showing variation of current with the frequency of the applied voltage. Explain briefly how the phenomenon of resonance in the circuit can be used in the turning mechanism of a radio or TV set.

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4. A series LCR circuit is connected to an a.c. source having voltage $V = V_m \sin \omega t$. Derive the expression for the instantaneous current I and its phase relationship to the applied voltage.

Obtain the condition for resonance to occur. Define 'power factor'. State the conditions under which it is (i) maximum and (ii) minimum.

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Topic 2 Numerical Problem

1. A sinusoidal voltage of peak value 283 V and frequency 50 Hz is applied to a series LCR circuit in which $R = 3\Omega, L = 25.48mH,$ and $C = 796\mu F$. Find (a) the impedance of the circuit, (b) the phase difference between the voltage across the source and the current, (c) the power dissipated in the circuit, and (d) the power factor.

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2. A series LCR circuit is connected to 230 V a.c. source of variable frequency. The inductance of the coil is 5 H capacitance of the capacitor is $5\mu F$ and resistance is 40Ω. At resonance calculate , (a) The resonant frequency , (b) current is the circuit and (c) the inductive reactance.

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3. A 60 V, 10 W lamp is to be run on 100 V, 60 Hz a.c. mains. Calculate the inductance of a chock required to be connected in series with it to work the bulb.

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4. A series LCR circuit with $R = 20\Omega, L = 1.5H,$ and $C = 35\mu F$ is connected to a variable frequency 200 V ac supply. When the frequency of the supply equals the natural frequency of the circuit, what is the average power transferred to the circuit in one complete cycle?

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5. Obtain the resonant frequency ω_r of a series LCR circuit with L = 2.0 H. $C = 32\mu F$, and $R = 10\Omega$. What is the Q - value of this circuit?

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6. An a.c. source of 220 V 50 Hz is connected in series with a 50Ω resistance $150\mu F$ capacitors and 0.5 H inductor in series. Calculate

the current through the combination.

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7. A bulb connected to 50 V d.c. consumes 20 W power. Then the bulb is connected to a capacitor in an a.c. power supply of 250 V, 50 Hz. Find the value of the capacitor required so that the bulb drows the same amount of current.

Data : P = 20 W, V = 50 V, v = 50 Hz, C = ?

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8. An a.c. voltage represented be e = 310 sin 314 t is connected in series to a 24Ω resistor, 0.1 H inductor and a $25\mu F$ capacitor. Find the value of the peak voltage rms voltage frequency rectus of the circuit impedance of the circuit and phase angle of the current.

Data : $R = 24\Omega, L = 0.1H, C = 25 \times 10^{-6}F$

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9. A call is connected across 250 V, 50 Hz supply and it draws a current of 2.5 A and consumes power of 400 W. Find the self inductance and power factor.

Data :

$E_{rms} = 250V, v = 50Hz, I_{rms} = 2.5A, P = 400W, L = ?, \cos\phi = ?$

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10. The figure shows a series LCR circuit with $L = 5.0H, C = 80\mu F, R = 40\Omega$ connected to a variable frequency of 240 V source. Calculate

(i) The angular frequency of the source which drives the circuit at resonance.

(ii) The current at the resonating frequency.

(iii) The rms potential drop across the capacitor at resonance.

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11. A series LCR circuit is connected to a 220 V variable frequency supply. If L = 20 mH, $C = \left[\frac{800}{\pi^2}\right]\mu F$ and $R = 110\Omega$,

(a) Find the frequency of the source for which the average power absorbed by the circuit is maximum.

(b) Calculate the value of maximum current amplitude.

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Topic 3 Very Short Answer Type Questions

1. Show a plot of variation of alternating emf versus time generated by a loop of wire rotating in a magnetic field.

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2. The core of the transformer is laminated to :

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3. Mention the two characteristic properties of the material suitable for making core of a transformer.

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Topic 3 Short Answer Type Questions I

1. Mention the principle behind the working of a transformer. Can a transformer used to step up a d.c. voltage ?

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2. State the underlying principle of a transformer. How is the large-scale transmission of electric energy over long distances done with the use of transformers ?

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3. An athlete peddles a stationary tricycle whose pedals are attached to a coil having 100 turns age of area $0.1m^2$. The coil, line in the X-Y plane is rotated in this plane at the rate of 50 rpm about the Y-axis in a region where a uniform magnetic field $\overrightarrow{B} = (0.01)k$, tesla is present. Find the

(i) maximumemf

(ii) average emf

generated in the call over one complete revolution.

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Topic 3 Short Answer Type Questions Ii

1. A wheel with 8 metallic spokes is 50 cm long is rotated with the speed of 120 rev/min in a plane normal to the horizontal component of the earth magnetic field. The Earth's magnetic field at the place of 0.4 G and the angle of dip is 60°. Calculate the emf induced between the axel and the rim of the wheel. How will the value of emf be affected if the number of spokes were increased.

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Topic 3 Long Answer Type Questions

1. Draw a neat labelled diagram of an ac generator or dynamo.

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2. How is magnetic flux linked with the armature coil changed in a generator ?

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3. Give the expression for maximum induced emf in an ac generator.

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4. Show the variation of the emf generated versus time as the armature is rotated with respect to the direction of the magnetic field.

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5. Draw a schematic arrangement for winding of primary and secondary coil in a transformer when the two coils are found on top of each other.

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6. State the underlying principle of a transformer and obtain the expression for the ratio of secondary to primary voltage in terms of the three

(i) number of secondary and primary winding send

(ii) primary and secondary currents.

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7. Write the main assumption involved in deriving the above relation.

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8. What is the principle behind the working of a transformer ? Mention any two sources of energy loss in transformer

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9. With the help of a labelled diagram describe briefly the underlying principle and working of a step up transformer.

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10. What is a transformer ? Mention two sources of energy loss in a transformer

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11. A step up transformer converts a low input voltage into a high output voltage. Does it violet law of conservation of energy Explain?

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12. State the underlying principle of a transformer. How is the large-scale transmission of electric energy over long distances done with the use of transformers ?

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