PHYSICS CLASS XII
CHAPTER – 7 ALTERNATING CURRENT

Q.1. The instantaneous current and voltage of an AC circuit is given by

I = 10sin314t A and V = 50sin314t V.

What is the power dissipation in the circuit?

Ans. I = 10sin314t ; V = 50sin314t

I_0 = 10; E_0 = 50, here E = V

$$I_V = \frac{I_0}{\sqrt{2}} = \frac{10}{\sqrt{2}} = 5\sqrt{2}$$

$$E_V = \frac{50}{\sqrt{2}} = 25\sqrt{2}$$

Power dissipated = $E_V I_V = 5\sqrt{2} \times 25\sqrt{2}$

= 125 × 2 = 250 W

Q.2. Where is the power dissipation in an AC circuit?

Ans. Power is dissipated only in resistance.

Q.3. What is the minimum and maximum value of power factor?

Ans. Zero and one

Q.4. How can you improve the quality factor of a series resonance circuit?

Ans. To improve quality factor ohmic resistance should be made as small as possible.

Q.5. Write the name of quantities which during transformer operations does not change?

Address: Plot No 420, Behind Shopprix Mall, Vaishali Sector 5, Ghaziabad – 201010
M: 9999907099, 9818932244 O: 0120-4130999
Website: www.vaishalieducationpoint.com , www.educationsolution.co

Ans. Power and frequency.

Q.6. Define choke coil. Determine the impedance of tube circuit with choke coil?

Ans. Choke coil is simply a coil connected in series with the tube light. It has large inductance but small resistance and used to reduce the AC voltage between terminals of the tube for the purpose of safety of tubelight.

Q.7. Mention the two characteristic properties of the material suitable for making core of a transformer.

Ans. (i) Low retentivity or coercivity.

(ii) Low hysteresis loss or high permeability and susceptibility.

Q.8. What is the function of a step-up transformer?

Ans. Step-up transformer converts low alternating voltage/into high alternating voltage.

Q.9. Write the four most general quantities, which are of the alternating nature for transformer circuit.

Ans. Current, voltage, induced emf and flux.

Q.10. In India domestic supply of power is at 220 V whether it is phase to phase voltage of supply or phase to neutral voltage?

Ans. 220V is the phase to neutral voltage of supply while phase to phase voltage is 440 V. (Both are rms value)

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

Address: Plot No 420, Behind Shopprix Mall, Vaishali Sector 5, Ghaziabad – 201010
M: 9999907099, 9818932244 O: 0120-4130999
Website: www.vaishalieducationpoint.com , www.educationsolution.co

Ans. No, it does not violates. Law of conservation of energy, if voltage increases then current decrease.

Q.12. In an AC circuit the applied instantaneous voltage equal to the algebraic sum of the instantaneous voltages across the series elements of the circuit? Is the same true for rms voltage?

Ans. (i) Yes, it is true for instantaneous voltage.

(ii) No, it is not true for rms voltage because voltages across various elements may not be in same phase.

Q.13. A capacitor is used in the primary circuit of induction coil. Why?

Ans. Because when the circuit is broken then the large amount of induced voltage is used up in charging the capacitor. Thus sparking is avoided.

Q.14. A choke coil in series with a lamp is connected to a DC line. The lamp is seen to shine brightly. If an iron core is inserted in the choke which causes no change in the lamp's brightness. Predict the observations if the connection is to an AC line.

Ans. A choke has no impedance if it is connected to DC line. Therefore lamp shines brightly and has no effect on inserting iron core in the choke.

But choke offers impedance if it is connected to AC line. So the bulb lights dimly. When an iron core is inserted in the choke, the impedence to AC increases. Hence, the brightness of the bulb decreases.

Address: Plot No 420, Behind Shopprix Mall, Vaishali Sector 5, Ghaziabad – 201010
M: 9999907099, 9818932244 O: 0120-4130999
Website: www.vaishalieducationpoint.com , www.educationsolution.co

Q.15. A transformer has 150 turns in its primary and 1000 is secondary. If the primary is connected to 440 V DC supply, what will be the induced voltage in the secondary side.

Ans. Zero, as transformer works only in AC and in case of DC supply, there is no induced emf in secondary because there is no change in flux through the transformer circuit.

Q.16. Both alternating current and direct current are measured in amperes. But how is the ampere defined for an alternating current?

Ans. As we know that the AC current changes its direction with time. So, AC ampere must be defined in terms of some property which is independent of direction of current. Thus, Joule's heating effect is the property which defines rms value of AC.

Q.17. A small town with a demand of 800 kW of electric power at 220 V is situated 15 km away from an electric plant generating power at 440 V. The resistance of the two wire line carrying power is 0.5 Ω per km. The town gets power from the line through a 4000-220 V step-down transformer at a sub-station in the town.

(i) Estimate the line power loss in the form of heat.

(ii) How much power must the plant supply, assuming there is negligible power loss due to leakage?

(iii) Characterise the step-up transformer at the plant.

Address: Plot No 420, Behind Shopprix Mall, Vaishali Sector 5, Ghaziabad – 201010
M: 9999907099, 9818932244 O: 0120-4130999
Website: www.vaishalieducationpoint.com , www.educationsolution.co

Ans. Generating power of electric plant

= 800 k W at V = 220 V

Distance = 15 km

Generating voltage = 440 V

Resistance/length = 0.5 Ω/km

Primary voltage, V_P = 4000 V

Secondary voltage V_S = 220 V

(i) Power = I_P . V_P

800 ×1000 = I_P × 4000 or I_P = 200 A

Line power loss in form of heat = $(I_P)^2$ × Resistance of line (2 lines)

= $(I_p)^2$ × 0.5 × 15 × 2 = $(200)^2$ × 0.5 × 15 × 2

= 60 × 10^4 W = 600 kW

(ii) If there is no power loss due to leakage,

The plant supply should be = 800 + 600 = 1400 kW

(iii) Voltage drop across the line = I_P · R (2 lines)

= 200 × 0.5 × 15 × 2 = 3000 V

Voltage from transmission = 3000 + 4000 = 7000 V

As it is given that the power generator at 440 V. So, the step-up transformer needed at the plant is 440V-7000 V.

Address: Plot No 420, Behind Shopprix Mall, Vaishali Sector 5, Ghaziabad – 201010
M: 9999907099, 9818932244 O: 0120-4130999
Website: www.vaishalieducationpoint.com , www.educationsolution.co

Q.18. Raj Pal Yadav, a retired Physics teacher was working in his field with his grandson. There was a big high tension tower carrying thick wires in their field. Grandson wanted to know as to why can't the tower be removed from their field, so that they may get more space for crops. Raj Pal explained him the necessity of HT tower, and said it is very high voltage AC transmission line and is a lifeline of their town.

(i) What values are displayed by Raj Pal Yadav?

(ii) Why long distances AC transmission is done at very high voltage?

Ans. (i) Social awareness

(ii) To minimize power loss due to generation of heat.

Q.19. Krishna a retired science teacher was walking with his grandson Munna by the side of a paddy field. Munna noticed power grids carrying thick wires. He was curious to know what the structure was and what the wires were for. So he asked his grandfather about it. He also wanted to know if the tower could be removed so that there would be more space for crops. Krishna explained in detail about the tower and the need for the wires.

(i) Why is the voltage stepped up for long distance transmission?

(ii) What are the values exhibited by Krishna and Munna?

Ans. (i) The loss of power in the transmission lines is I^2R. To reduce the power loss, AC is transmitted over long distance at extremely high voltages.

Address: Plot No 420, Behind Shopprix Mall, Vaishali Sector 5, Ghaziabad – 201010
M: 9999907099, 9818932244 O: 0120-4130999
Website: www.vaishalieducationpoint.com , www.educationsolution.co

(ii) Concern for saving energy and greenery.

Q.20. Nita switched on the radio set to listen to her favorite music but found the reception was not clear. Also there was overlapping of signals. So she adjusted the tuner in the set till heard the music clear.

(i) What are the components of turning circuit in a radio?

(ii) Name the phenomenon involved here?

(iii) What value can be associated with this?

Ans. (i) By adjusting the tuner, she would have changed the capacitance value and adjusted the frequency.

(ii) Resonance.

(iii) Harmony. By being in harmony with nature, life would be beautiful and easy for the future generation.

Q.21. Anand on entering his apartment, switched on the tube light, but it did not work. So he called the electrician. The electrician inspected the tube light and suggested a replacement of the choke. On replacing the choke anand found the tube light working.

(i) What is the function of choke?

(ii) Identify the value exhibited here?

Ans. (i) To reduce the current in the circuit without any heat loss.

(ii) Concern for conserving energy and to avoid short-circuit.

Address: Plot No 420, Behind Shopprix Mall, Vaishali Sector 5, Ghaziabad – 201010
M: 9999907099, 9818932244 O: 0120-4130999
Website: www.vaishalieducationpoint.com , www.educationsolution.co

Q.22. Monica had from Singapore in a holiday to her grandmother's place. She had heard a lot about Tirupathi temple and so she went to Tirupathi with her grandmother. She walked through a metal detector and heard a beep sound as she walked through it. When she went back to Singapore she asked her father about the metal detector and its working. Her father explained the working in detail and also the need for installing metal detectors in place where people visited in huge numbers.

(i) Name the components present in the detector.

(ii) What is the phenomenon involved?

(iii) What value can be attached with his?

Ans. (i) An inductor and a capacitor.

(ii) Resonance.

(iii) Concern for social security.

Address: Plot No 420, Behind Shopprix Mall, Vaishali Sector 5, Ghaziabad – 201010
M: 9999907099, 9818932244 O: 0120-4130999
Website: www.vaishalieducationpoint.com , www.educationsolution.co