Physicsaholics

DPP – 3 (Alternating Current)

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Written Solution on Website:- https://physicsaholics.com/note/notesDetalis/60

Q 1. Which of these is not correct regarding eddy currents?
(a)Eddy currents result due to motion of a metallic plate in magnetic field
(b)Eddy currents are minimised in transformer by using laminated core with metal laminations separated by some insulating material
(c)In induction furnace, eddy currents in metal to be melted raise temperature of the metal, melting it
(d)Eddy currents are named so, as they propagate similar to swirling eddies in water

Q 2. The windings of a transformer have an inductance L_1 = 6 H, L_2 = 0.06 H and a coefficient of coupling K = 0.9. Find the emf induced in both windings when the primary current increases at the rate of 1000 A/s. (L_1 is inductance of primary winding)
(a) 270 V
(b) 540 V
(c) 135 V
(d) 220 V

Q 3. A 220 volt input is supplied to a transformer. The output circuit draws a current of 2.0 ampere at 440 volts. If the efficiency of the transformer is 80%, the current drawn by the primary windings of the transformer is –
(a) 3.6 ampere (b) 2.8 ampere
(c) 2.5 ampere (d) 5.0 ampere

Q 4. The primary of a 1 : 3 step - up transformer is connected to a source and the secondary is connected to a resistor R. The power dissipated by R in this situation is P. If R is connected directly to the source it will dissipate a power of :
(a) P/9 (b) P/3 (c) P (d) 3P

Q 5. An ideal efficient transformer has a primary power input of 10kW. The secondary current when the transformer is on load is 25A. If the primary : secondary turns ratio is 8 : 1, then the potential difference applied to the primary coil is
(a) $\frac{10^4\times8^2}{25}V$ (b) $\frac{10^4\times8}{25}V$ (c) $\frac{10^4}{25\times8}V$ (d) $\frac{10^4}{25\times8^2}V$

Q 6. A transformer is used to light a 140 watt, 24 volt lamp from 240 V AC mains. The current in the main cable is 0.7 amp. The efficiency of the transformer is :
(a) 48% (b) 63.8% (c) 83.3% (d) 90%

Q 7. A step down transformer reduces 220 V to 110 V. The primary draws 5 ampere of current and secondary supplies 9 ampere. The efficiency of transformer is –

(a) 20% (b) 44% (c) 90% (d) 100%

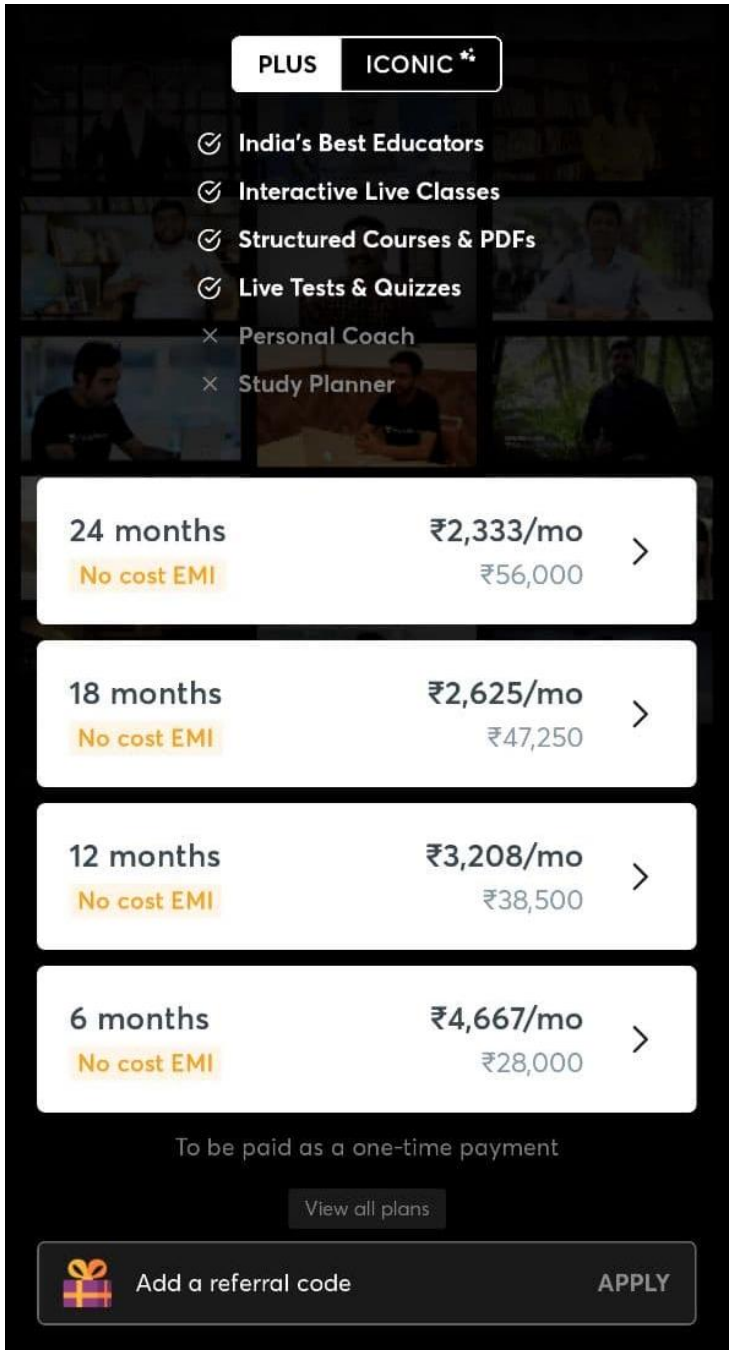
Q 8. In a transformer Np = 500, Ns = 5000. Input voltage is 20V and frequency is 50Hz. What are the output voltage and frequency –
(a) 200 V, 40 Hz (b) 100 V, 50 Hz
(c) 200 V, 50 Hz (d) 150 V, 40 Hz

Q 9. A step up transformer is used on 120 V line to provide a P.D. of 2400 V. If the number of turns in primary is 75, then the number of turns in the secondary shall be
(a) 25 (b) 150 (c) 1500 (d) 500

Q 10. In a step down transformer having primary to secondary turn ratio 20 : 1, the input voltage applied is 250 volts and output current is 8 amp. Assuming 100% efficiency, calculate the power input
(a) 10 W
(b) 20 W
(c) 50 W
(d) 100 W

Answer Key

Q.1 a	Q.2 b	Q.3 d	Q.4 a	Q.5 b
Q.6 c	Q.7 c	Q.8 c	Q.9 c	Q.10 d



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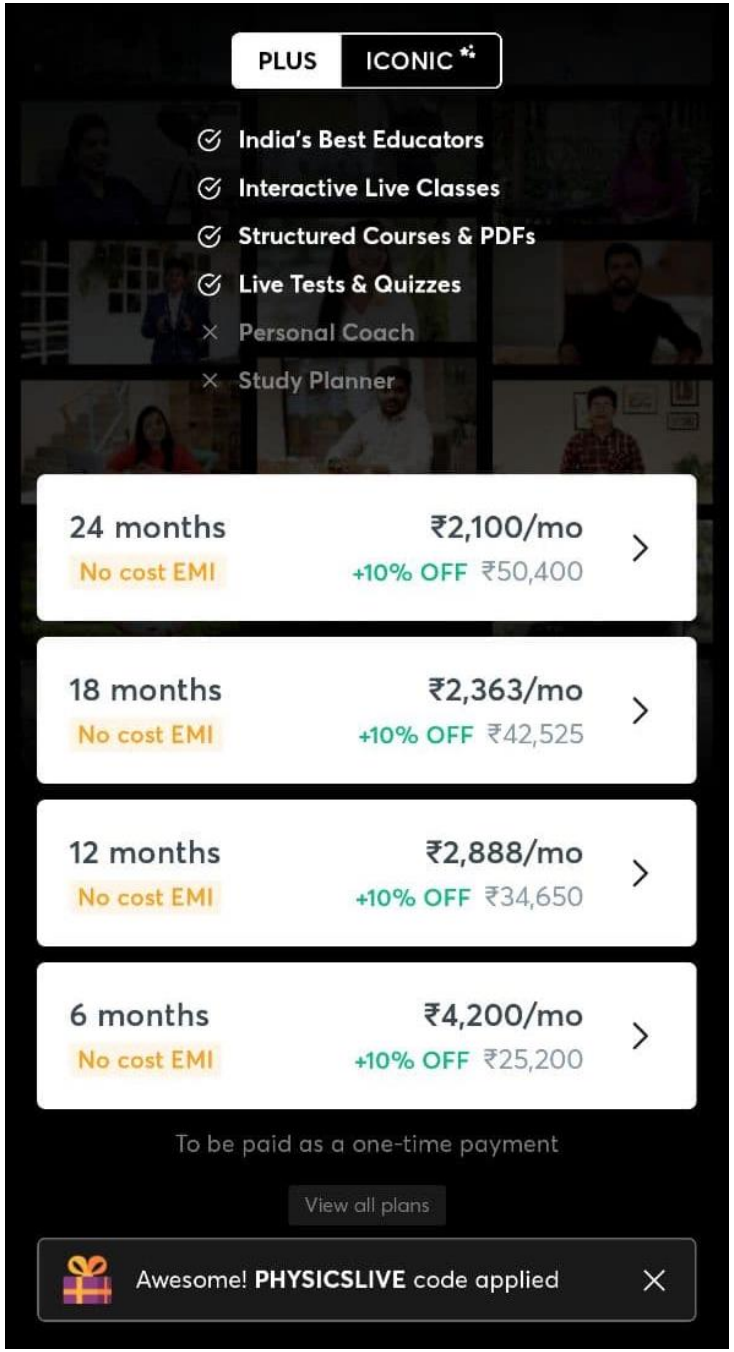
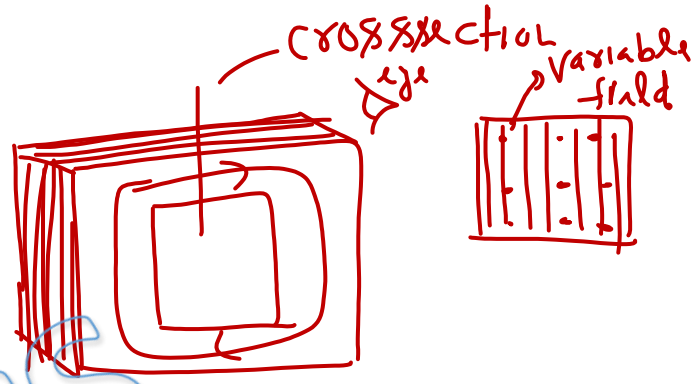


Written Solution

DPP- 3 Alternating Current : Transformer

By Physicsaholics Team

Q.1) Which of these is not correct regarding eddy currents?



(a)Eddy currents result due to motion of a metallic plate in magnetic field

(b)Eddy currents are minimised in transformer by using laminated core with metal laminations separated by some insulating material

(c)In induction furnace, eddy currents in metal to be melted raise temperature of the metal, melting it

(d)Eddy currents are named so, as they propagate similar to swirling eddies in water

Q.2) The windings of a transformer have an inductance L_1 = 6 H, L_2 = 0.06 H and a coefficient of coupling K = 0.9. Find the emf induced in both windings when the primary current increases at the rate of 1000 A/s. (L_1 is inductance of primary winding)

$M = K\sqrt{L_1 L_2}$

$= .9\sqrt{6 \times 06} = .54$

$\mathcal{E} = M\frac{di}{dt}$

$= .54 \times 1000$

$= 540\,V$

(a) 270 V

(b) 540 V

(c) 135 V

(d) 220 V

Q.3) A 220 volt input is supplied to a transformer. The output circuit draws a current of 2.0 ampere at 440 volts. If the efficiency of the transformer is 80%, the current drawn by the primary windings of the transformer is –

(a) 3.6 ampere (b) 2.8 ampere

(c) 2.5 ampere (d) 5.0 ampere

$$\eta = \frac{V_0 I_0}{V_{in} I_{in}} \times 100$$

$$80 = \frac{440}{220} \times \frac{2}{I_{in}} \times 100$$

$$I_{in} = \frac{4 \times 10}{8_2} = 5\,A$$

Q.4) The primary of a 1 : 3 step - up transformer is connected to a source and the secondary is connected to a resistor R. The power dissipated by R in this situation is P. If R is connected directly to the source it will dissipate a power of :

V_{in}

$V_0 = 3V_{in}$

$P = \frac{V_0^2}{R} = \frac{9V_{in}^2}{R}$

(a) P/9 (b) P/3 (c) P (d) 3P

If source is connected directly to R

$P' = \frac{V_{in}^2}{R} = \frac{P}{9}$

$P_{in} = P_{out}$

Q.5) An ideal efficient transformer has a primary power input of 10kW. The secondary current when the transformer is on load is 25A. If the primary : secondary turns ratio is 8 : 1, then the potential difference applied to the primary coil is

$P_0 = 10000\,W$, $I_0 = 25\,A$

$\Rightarrow V_0 = \frac{P_0}{I_0} = \frac{10000}{25} = 400\,V$

$\frac{V_{in}}{V_0} = \frac{N_1}{N_2} \Rightarrow \frac{V_{in}}{400} = \frac{8}{1} \Rightarrow V_{in} = 3200$

(a) $\frac{10^4 \times 8^2}{25} V$ (b) $\frac{10^4 \times 8}{25} V$ (c) $\frac{10^4}{25 \times 8} V$ (d) $\frac{10^4}{25 \times 8^2} V$

Q.6) A transformer is used to light a 140 watt, 24 volt lamp from 240 V AC mains. The current in the main cable is 0.7 amp. The efficiency of the transformer is :

output

input

input

$$\therefore \eta = \frac{(V_0 I_0)}{V_{in} I_{in}} \times 100$$

$$= \frac{140}{240 \times 0.7} \times 100 = \frac{500}{6} = 83.3\%$$

(a) 48% (b) 63.8% (c) 83.3% (d) 90%

Q.7) A step down transformer reduces 220 V to 110 V. The primary draws 5 ampere of current and secondary supplies 9 ampere. The efficiency of transformer is -

$$\eta = \frac{V_0 I_0}{V_i I_i} \times 100$$

$$= \frac{110 \times 9}{220 \times 5} \times 100 = 90\%$$

(a) 20% (b) 44% (c) 90% (d) 100%

Q.8) In a transformer Np = 500, Ns = 5000. Input voltage is 20V and frequency is 50Hz. What are the output voltage and frequency -

Output freq = input freq = 50 Hz

$$\frac{V_0}{V_{in}} = \frac{N_s}{N_p}$$

$$\frac{V_0}{20} = \frac{5000}{500}$$

$V_0 = 200\,V$

(a) 200 V, 40 Hz
(b) 100 V, 50 Hz
(c) 200 V, 50 Hz
(d) 150 V, 40 Hz

Q.9) A step up transformer is used on 120 V line to provide a P.D. of 2400 V. If the number of turns in primary is 75, then the number of turns in the secondary shall be -

input ↑ output ↑

$$\frac{V_0}{V_{in}} = \frac{N_2}{N_1}$$

$$\frac{2400}{120} = \frac{N_2}{75}$$

$$N_2 = 1500$$

(a) 25 (b) 150 (c) 1500 (d) 500

Q.10) In a step down transformer having primary to secondary turn ratio 20 : 1, the input voltage applied is 250 volts and output current is 8 amp. Assuming 100% efficiency, calculate the power input

$\frac{V_{in}}{V_0} = \frac{N_1}{N_2}$

(a) 10 W

(b) 20 W

(c) 50 W

(d) ~~100 W~~

Power input = Power output

$= V_0 I_0$

$= \left(\frac{N_2}{N_1}\right) \times V_{in} \times I_0$

$= \frac{1}{20} \times 250 \times 8$

$= 100 W$

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