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Class: XII
Subject: Physics
Topic: Electromagnetic induction & Alternating Current
No. of Questions: 20
Duration: 60 Min
Maximum Marks: 60

1. The induced e.m.f. in a coil rotating in a uniform magnetic field depends upon
   a. only on total number of turns in the coil
   b. only on magnetic field
   c. area of coil and speed of rotation
   d. all of the above

   Ans. D

   Solution:
   D (E = n ABω, so it depends on all these.)

2. In LCR circuit, p.d. between the terminals of inductance is 60 V, between terminals of capacitor is 30 V and between the terminals of resistance is 40 V. The supply voltage will be equal to
   a. 50 V
   b. 70 V
   c. 130 V
   d. 10 V

   Ans. A
   Solution:
   $$V = \sqrt{V_R^2 + (V_L - V_C)^2}$$
   $$= \sqrt{(40)^2 + (60 - 30)^2} = \sqrt{1600 + 900} = \sqrt{2500} = 50\ V$$

3. Two different loops are concentric and lie in the same plane. The current in the outer loop is clockwise and increasing with the time. The induced current in the inner loop is
   a. Clockwise
   b. Zero
   c. counter clockwise

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d. In a direction that depends on the ratio of the loop radii

Ans. C

4. A circuit has a resistance of 30 Ω in series with an inductive reactance of 40 Ω. Both are in series with an A.C with peak current value 1Aand peak voltage 220V. The power consumed in the circuit is
   a. 66WB
   b. 6.6WC
   c. 660WD
   d. 6600W

   Ans. A

   Solution:

   $$\text{Power consumed} = \frac{E_o I_o}{2}\cos f$$

   $$\text{But } z = \sqrt{R^2 + X_L^2} = \sqrt{(30)^2 + (40)^2} = 50 \text{ W}$$

   $$\therefore \cos f = \frac{R}{Z} = \frac{30}{50} = 0.6$$

   $$\therefore \text{Power consumed} = \frac{220 \times 1 \times 0.6}{2} = 66W$$

5. Effective voltage is given by expression
   a. $V_o / \sqrt{2}$
   b. $\sqrt{2}\, V_o$
   c. $\frac{V_o}{\pi}$
   d. πV_o

   Ans. A

6. Capacitive reactance of DC circuit is
   a. $\frac{1}{\omega c}$
   b. $\frac{1}{2\pi fc}$
   c. ¥
   d. either 1and 2

   Ans. C

7. The magnetic field intensity at a distance 10cm from an infinitely straight conductor is 10-5 T. The current in the conductor is
   a. 5 A B .
   b. 10 A C .
   c. 50 A D .
   d. 100 A

   Ans. B

8. In ac motor, a capacitor is used to
   a. reduce ripple
   b. reduce A.C.
   c. introduce phase difference of $\frac{\pi}{2}$
   d. increase A.C.

   Ans. C
   Solution:
   The capacitor introduces a phase difference of □/2 which is necessary for motors.

9. In an AC dynamo, the peak value of the emf is 60 votls. The emf induced in a positionwhen the armature makes an angle of 30º. With themagnetic field perpendicular with the coil is
   a. 20 V
   b. 30 √2 V
   c. 30 V
   d. 45V

   Ans. C
   Solution:

$$E = E_o \sin wt = 60 \times \frac{1}{2} = 30 \ V \qquad wt = 30^\circ$$

10. The induced emf in a coil is independent of
    a. resistance of the circuit
    b. the number of turns in the coil
    c. the change in the magnetic flux
    d. time

    Ans. A

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11. An a.c having a peak value 28 A is used to heat a metal wire. To produce the same heating effect a constant current i that can be used is
    a. 28 A
    b. about 20 A
    c. 7 A
    d. about 10 A

    Ans. B
    Solution:

    By definition , answer $I_{rms} = \frac{I_o}{\sqrt{2}} = \frac{28}{\sqrt{2}} = 20A$

12. In a series LCR circuit at a particular frequency the inductive and capacitive phasors are equal and opposite
    a. the impedance is virtual
    b. the circuit is in electrical resonance
    c. the current amplitdue isminimum
    d. the power dissipated isminimum

    Ans. B

13. If the power factor changes from $\frac{1}{2}$ to $\frac{1}{4}$ then what is the increase in impedance in A.C.?
    a. 20 %
    b. 50 %
    c. 25 %
    d. 100%

    Ans. D
    Solution:

    $\cos\theta \propto \frac{1}{Z}$

    $\frac{Z_1}{Z_2} = \frac{\cos q_1}{\cos q_2} = \frac{1/4}{1/2} = \frac{1}{2}$

    $Z_2 = 2Z_1$

    Percentage change = $\frac{2Z_1 - Z_1}{Z_1} \times 100 = 100\ \%$

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14. An electric current wave is given by i = (10 + 10 sin100πt) A. Its average value over one time period is given as
(A) 10 A
(B) 5 A
(C) $\sqrt{50}$ A
(D) Zero.

Ans. A

Solution: Integrate the current function with respect to time and divide by the time period.

15. For DC, pure inductor behaves as
a. an "open"
b. a "short"
c. either "open or "short" depending on the current
d. never as "open' nor as "short"
Ans. B

16. The magnetic flux through a coil perpendicular to its plane and directed into paper is varying according to relation □ = 5t2 + 10t + 5 milli weber. The e.m.f. induced in the loop after 5 sec 15
a. 0.03 volt
b. 0.06 volt
c. 0.08 volt
d. 0.02 volt

Ans. B
Solution:

$$\phi = (5t^2 + 10t + 5) \times 10^{-3} \text{ Wb}$$

$$\text{as } e = \frac{d\phi}{dt} \text{ (in magnitude)}$$

$$\frac{d}{dt}(5t^2 + 10t + 5) \times 10^{-3} \text{ Wb sec}^{-1}$$

$$= (10t + 10)\, 10^{-3} \text{ volt}$$

$$\therefore\ e = (10 \times 5 + 10) \times 10^{-3} = 0.06 \text{ volt}$$

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17. If E represents the peak value of the voltage in an A. C circuit, the r.m.s value of the
    a. E / ð
    b. E/2
    c. E / √π
    d. E / 3

    Ans. D

18. The resonant frequency of a series LCR circuit is 100Hz. If the LC product is increased 16 times, the new resonant frequency is
    a. 1600 Hz
    b. 116 Hz
    c. 400 Hz
    d. 25 Hz

    Ans. D
    Solution:

$$f = \frac{1}{2p\sqrt{LC}}$$

$$f' = \frac{1}{2p\sqrt{16LC}} \Rightarrow f' = \frac{1}{2p\sqrt{16LC}} \Rightarrow f' = f/4 = \frac{100}{4} = 25 \ Hz.$$

19. When a series LCR circuit is not in resonance
    a. the peak energy stored by capacitor = peak energy stored by inductor
    b. the impedance is purely resistive
    c. the peak energy stored by capacitor ≠ peak energy stored by inductor
    d. the power factor is unity

    Ans. C

20. A train is moving with a speed of 30 m s^{-1} NS on the rails separated by 2 m. If the vertical component of earth's field is 8 x 10^{-5} T, the e.m.f. is
    a. 0.0048 V
    b. 0.048 V
    c. 0.48 V
    d. 4.8 V

    Ans. A
    Solution:
    e = Blv = 30 x 2 x 8 x 10^{-5}
    = 0.0048 V