12TH Electromagnetic Induction and Alternating Current TEST

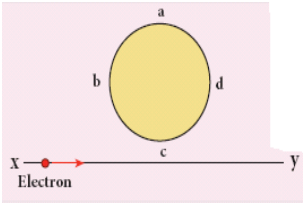
Exam Time: 03:00 Hrs
Date: 11/07/2025

Roll No: ____

Total Marks: 90

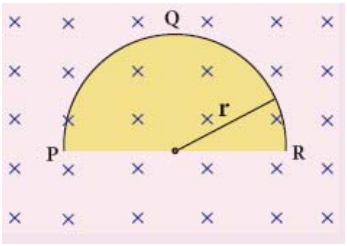
Multiple Choice Question 30 x 1 = 30

1. An electron moves on a straight line path XY as shown in the figure. The coil abcd is adjacent to the path of the electron. What will be the direction of current, if any, induced in the coil?



(a) The current will reverse its direction as the electron goes past the coil
(b) No current will be induced (c) abcd (d) adcb

2. A thin semi-circular conducting ring (PQR) of radius r is falling with its plane vertical in a horizontal magnetic field B, as shown in the figure.

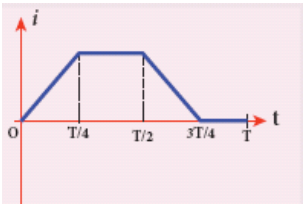


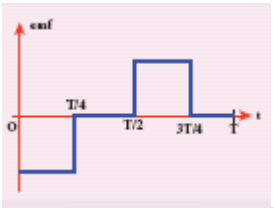
The potential difference developed across the ring when its speed v, is
(a) Zero (b) $\frac{Bv\pi r^2}{2}$ and P is at higher potential (c) πrBv and R is at higher potential
(d) 2rBv and R is at higher potential

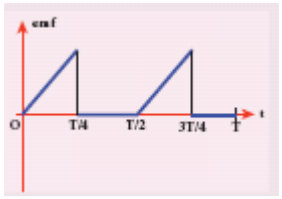
3. The flux linked with a coil at any instant t is given by $\Phi_B = 10t^2 - 50t + 250$. The induced emf at t = 3s is
(a) −190 V (b) −10 V (c) 10 V (d) 190 V

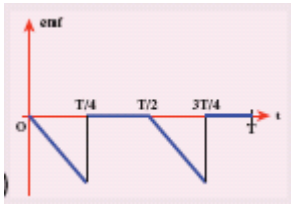
4. When the current changes from +2A to −2A in 0.05 s, an emf of 8 V is induced in a coil. The co-efficient of self-induction of the coil is
(a) 0.2H (b) 0.4H (c) 0.8H (d) 0.1H

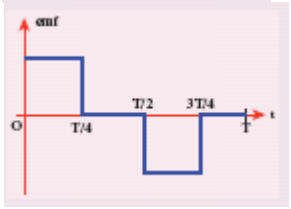
5. The current i flowing in a coil varies with time as shown in the figure. The variation of induced emf with time would be



(a) 

(b) 

(c) 

(d) 

6.A circular coil with a cross-sectional area of 4 cm^2 has 10 turns. It is placed at the centre of a long solenoid that has 15 turns/cm and a cross-sectional area of 10 cm^2. The axis of the coil coincides with the axis of the solenoid. What is their mutual inductance?

(a) 7.54 μH (b) 8.54 μH (c) 9.54 μH (d) 10.54 μH

7.In a transformer, the number of turns in the primary and the secondary are 410 and 1230 respectively. If the current in primary is 6A, then that in the secondary coil is

(a) 2 A (b) 18 A (c) 12 A (d) 1 A

8.A step-down transformer reduces the supply voltage from 220 V to 11 V and increase the current from 6 A to 100 A. Then its efficiency is

(a) 1.2 (b) 0.83 (c) 0.12 (d) 0.9

9.In an electrical circuit, R, L, C, and AC voltage source are all connected in series. When L is removed from the circuit, the phase difference between the voltage and current in the circuit is $\frac{\pi}{3}$. Instead, if C is removed from the circuit, the phase difference is again $\frac{\pi}{3}$. The power factor of the circuit is

(a) $1/2$ (b) $1/\sqrt{2}$ (c) 1 (d) $\sqrt{3}/2$

10.In a series RL circuit, the resistance and inductive reactance are the same. Then the phase difference between the voltage and current in the circuit is

(a) $\frac{\pi}{4}$ (b) $\frac{\pi}{2}$ (c) $\frac{\pi}{6}$ (d) zero

11.In a series resonant RLC circuit, the voltage across 100 Ω resistor is 40 V. The resonant frequency ω is 250 rad/s. If the value of C is 4 μF, then the voltage across L is

(a) 600 V (b) 4000 V (c) 400 V (d) 1 V

12.An inductor 20 mH, a capacitor 50 μF and a resistor 40Ω are connected in series across a source of emf V = 10 sin 340 t. The power loss in AC circuit is

(a) 0.76 W (b) 0.89 W (c) 0.46 W (d) 0.67 W

13.The instantaneous values of alternating current and voltage in a circuit are $i = \frac{1}{\sqrt{2}}\sin(100\pi t)$ A and v = $\frac{1}{\sqrt{2}}\sin\left(100\pi t + \frac{\pi}{3}\right)V$.The average power in watts consumed in the circuit is

(a) $\frac{1}{4}$ (b) $\frac{\sqrt{3}}{4}$ (c) $\frac{1}{2}$ (d) $\frac{1}{8}$

14.In an oscillating LC circuit, the maximum charge on the capacitor is Q. The charge on the capacitor when the energy is stored equally between the electric and magnetic fields is

(a) $\frac{Q}{2}$ (b) $\frac{Q}{\sqrt{3}}$ (c) $\frac{Q}{\sqrt{2}}$ (d) Q

15.$\frac{20}{\pi^2}H$ inductor is connected to a capacitor of capacitance C. The value of C in order to impart maximum power at 50 Hz is

(a) 50 μF (b) 0.5 μF (c) 500 μF (d) 5 μF

16. The self-inductance Lof a solenoid is given as _____.

(a) $L = \frac{\mu_o NA}{l}$ (b) $L = \frac{\mu_o NA^2}{l}$ (c) $L = \frac{\mu_o N^2 A}{l}$ (d) $L = \frac{\mu_o A}{Nl}$

17. Energy or workdone is stored in an inductor as _____.

(a) electrical energy (b) magnetic potential energy (c) electrical potential energy (d) heat energy

18. An alternator produces voltage waves equal to the number of _____ used.

(a) slip rings (b) windings (c) magnetsbrushes (d) brushes

19. In a transformer, eddy current loss is minimized by using _____.

(a) laminated core made of muemetal (b) laminated core made of stelloy (c) shell type core (d) thick copper wire

20. In an a.c. circuit with an inductor _____.

(a) voltage lags current by π/2 (b) voltage and current are in phase (c) voltage leads current by π (d) current lags voltage by π/2

21. The Q factor of an a.c circuit containing a resistance R, inductance L and capacitor C is _____.

(a) $Q = \frac{1}{\sqrt{LC}}$ (b) $Q = \frac{1}{R}\sqrt{\frac{C}{L}}$ (c) $Q = \frac{1}{R}\sqrt{\frac{L}{C}}$ (d) $Q = \frac{1}{\sqrt{LR}}$

22. In an LCR series a.c, circuit, the phase difference between current and voltage is 60°. If the net reactance of the circuit is 17.32Ω, the value of the resistance is _____.

(a) 30Ω (b) 17.32 Ω (c) 10 Ω (d) 1.732 Ω

23. When a bar magnet is introduced with a pole into the coil the galvanometer shows _____.

(a) momentary deflection (b) permanent deflection (c) deflection (d) zero

24. The strength of the induced current depends upon the speed with which the _____.

(a) emf changes (b) magneric field changes (c) flux changes (d) Area changes

25. A solenoid of area A length I and, number of turns N. If it is filled with material of permeability μ then its self-inductance is _____.

(a) $L = \frac{\mu A^2 N}{l}$ (b) $L = \frac{\mu l^2 A}{N}$ (c) $L = \frac{\mu N^2 A}{l}$ (d) $L = \frac{N^2 Al}{l}$

26. The coefficient of mutual induction behave a pair of coils depends upon _____.

(a) size of the coil (b) shape of the coil (c) number of turns (d) AII of these

27. When the angle of orientation $\omega t = \frac{\pi}{2}$ or $\frac{3\pi}{2}$ the value of the induced emf is _____.

(a) 0 (b) E_m (c) $NAB\,\omega$ (d) $-E_m$

28. When current flows through choke, the power dissipated is _____.

(a) maximum (b) zero (c) minimum (d) infinity

29. In a three-phase generator, the coils are displaced from each other by _____.

(a) 270° (b) 180° (c) 90° (d) 120°

30. In a coil emf of 5V is induced when a current in the coil change at the rate 100 A/s. The self-inductance of the coil is _____.

(a) 0.05 H (b) 5 H (c) 50 H (d) 0.005 H

2 Marks 6 x 2 = 12

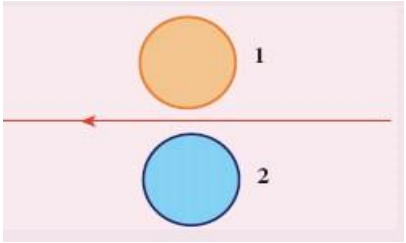
31. A cylindrical bar magnet is kept along the axis of a circular solenoid. If the magnet is rotated about its axis, find out whether an electric current is induced in the coil.

32. How will you define Q-factor?

33. What is meant by wattles current?

34. A straight metal wire crosses a magnetic field of flux 4 mWb in a time 0.4 s. Find the magnitude of the emf induced in the wire.

35. Using Lenz's law, predict the direction of induced current in conducting rings 1 and 2 when current in the wire is steadily decreasing.



36. When does power factor of a series RLC circuit become maximum?

3 Marks 6 x 3 = 18

37. Write down the equation for a sinusoidal voltage of 50 Hz and its peak value is 20 V. Draw the corresponding voltage versus time graph.

38. Find the impedance of a series RLC circuit if the inductive reactance, capacitive reactance and resistance are 184 Ω, 144 Ω and 30 Ω respectively.

39. A 500 μH inductor, $\frac{80}{\pi^2} pF$ capacitor and a 628 Ω resistor are connected to form a series RLC circuit. Calculate the resonant frequency and Q-factor of this circuit at resonance.

40. An inductor of inductance L carries an electric current i. How much energy is stored while establishing the current in it?

41. How will you induce an emf by changing the area enclosed by the coil?

42. Mention the various energy losses in a transformer.

5 Marks 6 x 5 = 30

43. Show mathematically that the rotation of a coil in a magnetic field over one rotation induces an alternating emf of one cycle. (or) Emf induced by changing relative orientation of the coil with the magnetic field.

44. Explain the construction and working of transformer.

45. Derive an expression for phase angle between the applied voltage and current in a series RLC circuit.

46. Obtain an expression for average power of AC over a cycle. Discuss its special cases.

47. Prove that the total energy is conserved during LC oscillations.

48. In an a.c circuit R = 4Ω; z = 5Ω, V_{rms} = 200V and I_{rms} = 1.5A calculate the average power consumed over a full cycle.