SHIKSHA CLASSES,BHANDARA

Subject : Physics **Topic : Electromagnetic Induction** **M.M. : 180**

Marking Scheme:
(i) Each question is allotted 4 (four) marks for each correct response.
(ii) ¼ (one fourth) marks will be deducted for indicating incorrect response of each question. No deduction from the total score will be made if no response is indicated for an item in the answer sheet.

Q.1 An a.c. of 50 Hz and 1 A peak value flows in the primary coil of a transformer. The mutual inductance between primary and secondary coils is 1.5 H. Then peak value of induced emf across secondary coil is:-
(1) 75 π volt (2) 150 π volt
(3) 225 volt (4) 300 volt

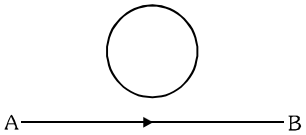
Q.2 When a current changes from 2A to 4A in 0.05 sec. in a coil, induced emf is 8 V. The self inductance of coil is :-
(1) 0.1 H (2) 0.2 H
(3) 0.4 H (4) 0.8 H

Q.3 The equivalent inductance of two inductances is 2.4 henry when connected in parallel and 10 henry when connected in series. The difference between the two inductances is
(1) 2 henry (2) 3 henry
(3) 4 henry (4) 5 henry

Q.4 A square coil of 0.01 m^2 area is placed perpendicular to the uniform magnetic field of 10^3 weber/metre^2. The magnetic flux linked with the coil is :-
(1) 10 weber (2) 10^{-5} weber
(3) Zero (4) 100 weber

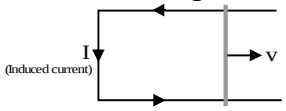
Q.5 A coil of resistance 10Ω and an inductance 5H is connected to a 100 volt battery. Then energy stored in the coil is :-
(1) 125 erg (2) 125 J
(3) 250 erg (4) 250 J

Q.6 The current flows from A to B as shown in the figure. The direction of the induced current in the loop is :-



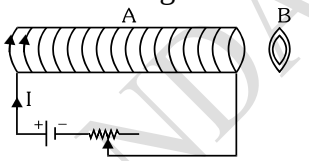
(1) clockwise (2) anticlockwise
(3) straight line (4) none of these

Q.7 For given arrangement (in horizontal plane) the possible direction of magnetic field:-



(1) towards right (2) towards left
(3) vertically upward (4) vertically downward

Q.8 An aluminium ring B faces an electromagnet A. The current I through A can be altered. Then which of the following statement is correct :-



(1) If I decreases A will repel B
(2) Whether I increases or decreases, B will not experience any force
(3) If I increases, A will repel B
(4) If I increases, A will attract B

Q.9 Mutual inductance of two coils when magnetic flux changes by 2×10^{-2} Wb and current changes by 0.01 A is :-
(1) 2 H (2) 3 H
(3) 4 H (4) 8 H

Q.10 Inductance of a solenoid is 3H and it consist of 500 turns. If number of turn make twice, then the value of self inductance becomes:-
(1) 1.5 H (2) 3 H
(3) 9 H (4) 12 H

Q.11 A coil of 10^{-2} H inductance carries a current I = 2sin (100t) A. When current is half of its maximum value, then at that instant the induced emf in the coil will be :-
(1) 1V (2) $\sqrt{2}$ V (3) $\sqrt{3}$ V (4) 2V

Q.12 An e.m.f. of 12 V is induced in a given coil when the current in it changes at the rate of 48 amp./min. The inductance of the coil is :–
(1) 0.5 henry (2) 15 henry
(3) 1.5 henry (4) 9.6 henry

Q.13 A circular coil of mean radius of 7 cm and having 4000 turns is rotated about its and of the diameter at the rate of 1800 revolutions per minute in the earth's magnetic field 0.5 gauss, the induced emf in coil will be :-
(1) 1.158 V (2) 0.58 V
(3) 0.29 V (4) 5.8 V

Q.14 Mutual inductance of two coils depends on their self inductance L_1 and L_2 as

(1) $M_{12} = L_1/L_2$ (2) $M_{12} = L_2/L_1$

(3) $M_{12} = \sqrt{L_1 L_2}$ (4) $M_{12} = \sqrt{L_1 / L_2}$

Q.15 The magnetic flux through a circuit of resistance R changes by an amount $\Delta\phi$ in a time Δt. The total quantity of electric charge Q that passes any point in the circuit during the time Δt is represented by :–

(1) $Q = \frac{\Delta\phi}{R}$ (2) $Q = \frac{\Delta\phi}{\Delta t}$

(3) $Q = R \cdot \frac{\Delta\phi}{\Delta t}$ (4) $Q = \frac{1}{R} \cdot \frac{\Delta\phi}{\Delta t}$

Q.16 A coil of 40 henry inductance is connected in series with a resistance of 8 ohm and the combination is joined to the terminals of a 2 volt battery. The time constant of the circuit is

(1) 1/5 sec (2) 40 sec

(3) 20 sec (4) 5 sec

Q.17 If number of turns of $70cm^2$ coil is 200 and it is placed in a magnetic field of 0·8 Wb/m^2 which is perpendicular to the plane of coil and it is rotated through an angle 180° in 0·1 sec, then induced emf in coil :-

(1) 11.2 V (2) 1.12 V

(3) 22.4 V (4) 2.24 V

Q.18 When current in a coil is reduced from 2A to 1A in 1 ms, the induced emf is 5V. The inductance of coil is :

(1) 5 H (2) 5000 H

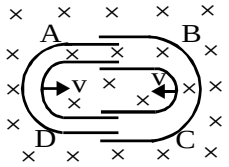
(3) 5 mH (4) 50 H

Q.19 A coil of inductance 300mH and resistance 2Ω is connected to a source of voltage 2V. The current reaches half of its steady state value in

(1) 0.3 s (2) 0.15 s

(3) 0.1 s (4) 0.05 s

Q.20 One conducting U tube can slide inside another as shown in figure, maintaining electrical contacts between the tubes. The magnetic field B is perpendicular to the plane of the figure. If each tube moves towards the other at a constant speed v, then the induced emf in the circuit, where ℓ is the width of each tube:



(1) $2B\ell v$ (2) Zero

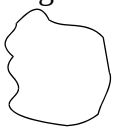
(3) $-B\ell v$ (4) $B\ell v$

Q.21 A conducting ring of radius 1 meter is placed in an uniform magnetic field B of 0·01 T, oscillating with frequency 100 Hz with its plane at right angles to magnetic field. What will be the induced electric field

(1) π volts/m (2) 2π volts/m

(3) 10 volts/m (4) 62 volts/m

Q.22 As a result of change in the magnetic flux linked to the closed loop shown in the figure, an e.m.f. V volt is induced in the loop. The work done (joules) in taking a charge Q coulomb once along the loop is



(1) QV (2) QV/2

(3) 2QV (4) Zero

Q.23 D.C. motor run by 120V. If armature current at e_b = 115V is 10 A. then find out current just after motor is started :-

(1) 240 A (2) 230 A

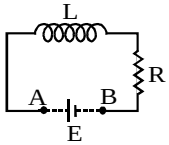
(3) 120 A (4) 400 A

Q.24 The flux linked with a coil at any instant 't' is given by $\phi = 10t^2 - 50t + 250$. Induced emf at t = 3s is

(1) 190 V (2) –190 V

(3) – 10 V (4) 10 V

Q.25 An inductor (L = 100 mH), a resistor (R = 100Ω) and a battery (E = 100 V) are initially connected in series as shown in the figure. After a long time the battery is disconnected after short circuiting the points A and B. The current in the circuit 1 ms after the short circuit is :-



(1) 1 A (2) (1/e) A

(3) e A (4) 0.1 A

Q.26 A metal rod of length 2 m is rotating with an angular velocity of 100 rad/sec in a plane perpendicular to a uniform magnetic field of 0.3T. The potential difference between the ends of the rod is –

(1) 30 V (2) 40 V (3) 60 V (4) 600 V

Q.27 A rectangular loop of sides a & b is placed in magnetic field B. The emf induced in coil when normal of coil makes angle ωt with B:

(1) BAωcosωt (2) BAωsinωt

(3) –BAωsinωt (4) –BAωsinωt

Q.28 A long solenoid has 500 turns. When a current of 2 ampere is passed through it, the resulting magnetic flux linked with each turn of the solenoid is 4×10^{-3} wb. The self–inductance of the solenoid is

(1) 1.0 henry (2) 4.0 henry

(3) 2.5 henry (4) 2.0 henry

Q.29 A conducting circular loop is placed in a uniform magnetic field 0.04 T with its plane perpendicular to the magnetic field. The radius of the loop starts shrinking at 2 mm/s. The induced emf in the loop when the radius is 2 cm is :-

(1) 1.6 π μV (2) 3.2 π μV

(3) 4.8 π μV (4) 0.8 π μV

Q.30 A rectangular, a square, a circular and an elliptical loop, all in the (x – y) plane, are moving out of a uniform magnetic field with a constant velocity, $\vec{V} = v\hat{i}$. The magnetic field is directed along the negative z axis direction. The induced emf, during the passage of these loops, out of the field region, will not remain constant for :-

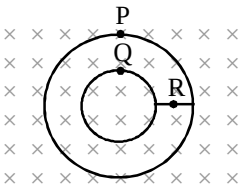
(1) any of the four loops.

(2) the rectangular, circular and elliptical loops.

(3) the circular and the elliptical loops.

(4) only the elliptical loop.

Q.31 Figure shows plane figure made of a conductor located in a magnetic field along the inward normal to the plane of the figure. The magnetic field starts increasing. Then choose the **incorrect** statement related to induced current –



(1) at point P, is anticlockwise

(2) at point Q, is clockwise

(3) at point Q, is anticlockwise

(4) at point R, is zero

Q.32 A condenser of capacity C is charged to a potential difference of V_1. The planes of the condenser are then connected to an ideal inductor of inductance L. The current through the inductor when the potential difference across the condenser reduces to V_2 is ?

(1) $\frac{C(V_1^2 - V_2^2)}{L}$ (2) $\frac{C(V_1^2 + V_2^2)}{L}$

(3) $\left(\frac{C(V_1^2 - V_2^2)}{L}\right)^{1/2}$ (4) $\left(\frac{C(V_1 - V_2)^2}{L}\right)^{1/2}$

Q.33 Mutual inductance M between two concentric coils of radius 1cm and 2m is : (in Tesla)

(1) $\frac{\mu_0\pi}{2} \times 10^{-4}$ (2) $\frac{\mu_0\pi}{4} \times 10^{-4}$

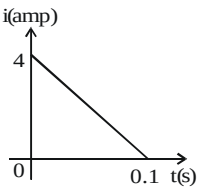
(3) $\frac{\mu_0\pi}{8} \times 10^{-4}$ (4) $\frac{\mu_0\pi}{10} \times 10^{-4}$

Q.34 Lenz law is consistent with conservation of :

(1) Energy (2) Mass

(3) Charge (4) Momentum

Q.35 In a coil of resistance 10 Ω, the induced current developed by changing magnetic flux through it, is shown in figure as a function of time. The magnitude of change in flux through the coil in Weber is:



(1) 6 (2) 4

(3) 8 (4) 2

Q.36 When the current through a solenoid increases at a constant rate, the induced current.

(1) is a constant and is in the direction of the inducing current.

(2) is a constant and is opposite to the direction of the inducing current.

(3) increase with time and is in the direction of the inducing current.
(4) increase with time and opposite to the direction of the inducting current.

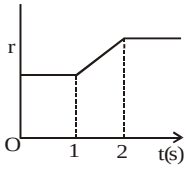
Q.37 According to Faraday's Laws of electro magnetic induction:
(1) The direction of the induced current is such that it opposes it self.
(2) The induced emf in the coil is proportional to the rate of change of magnetic flux associated with it.
(3) The direction of induced emf is such that it opposes it self.
(4) None of the above.

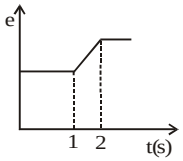
Q.38 A coil having an area of 2 m^2 is placed in a magnetic field which changes from 1 W/m^2 to 4 W/m^2 in 2seconds. The e.m.f. induced in the coil will be :
(1) 4 volt (2) 3 volt
(3) 2 volt (4) 1 volt

Q.39 A coil of resistance 10Ω and 1000 turns have the magnetic flux line of 5.5×10^{-4} Wb. If the magnetic flux changed 5×10^{-4} Wb. in 0.1 sec, then the induced charge in coil is :
(1) 50 μC (2) 5 μC
(3) 2 μC (4) 20 μC

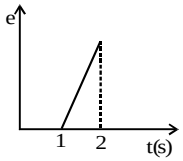
Q.40 One coil of resistance 40Ω is connected to a galvanometer of 160Ω resistance. The coil has radius 6mm and turns 100. This coil is placed between the poles of a magnet such that magnetic field is perpendicular to coil. If coil is dragged out then the charge through the galvanometer is 32μC. The magnetic field is:-
(1) 6.55 T (2) 5.66 T
(3) 0.655 T (4) 0.566 T

Q.41 A flexible wire bent in the form of a circle is placed in a uniform magnetic field perpendicular to the plane of the coil. The radius of the coil changes as shown figure. The induced emf in the coil is :-

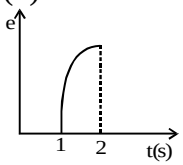




(1)



(2)



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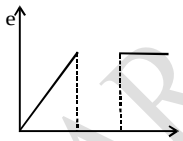

(4)

Q.42 A square loop of side 22 cm is changed to a circle in time 0.4 s. The magnetic field present is 0.2 T. The emf induced is :
(1) –6.6 mV (2) –13.2 mV
(3) +6.6 mV (4) +13.2 mV

Q.43 The magnetic flux in a coil of 100 turns increases by 12×10^3 Maxwell in 0.2 s due to the motion of a magnet. The emf induced in the coil will be :
(1) 0.6 mV (2) 0.6 V
(3) 6 V (4) 60 V

Q.44 Which one of the following can produce maximum induced emf :-
(1) 50 ampere dc (2) 50 ampere 50 Hz ac
(3) 50 ampere 500 Hz ac (4) 100 ampere dc

Q.45 A solenoid of 10 henry inductance and 2 ohm resistance, is connected to a 10 volt battery. In how much time the magnetic energy will be increases to (1/4)th of the maximum value?
(1) 3.5 sec (2) 2.5 sec
(3) 5.5 sec (4) 7.5 sec