ALLEN CAREER INSTITUTE KOTA (RAJASTHAN)

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PRE-MEDICAL

# PHYSICS

ENTHUSIAST | LEADER | ACHIEVER

EXERCISE

## Electromagnetic Induction (EMI)

ENGLISH MEDIUM

## EXERCISE-I (Conceptual Questions) — Build Up Your Understanding

### MAGNETIC FLUX

**1.** 'SI' unit of magnetic flux is :-

(1) ampere/meter$^2$ (2) weber

(3) gauss (4) orested

**EM0001**

**2.** 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

**EM0002**

### FARADAY LAW & LENZ'S LAW

**3.** 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

**EM0003**

**4.** A coil having an area of 2 m$^2$ is placed in a magnetic field which changes from 1 Weber/m$^2$ to 4 Weber/m$^2$ in 2 seconds. The e.m.f. induced in the coil will be :–

(1) 4 volt (2) 3 volt

(3) 2 volt (4) 1 volt

**EM0004**

**5.** Magnetic field through a coil is changed with respect to time then emf induced in it then select the incorrect regarding induced emf in coil :-

(1) Coil may be made up with wood

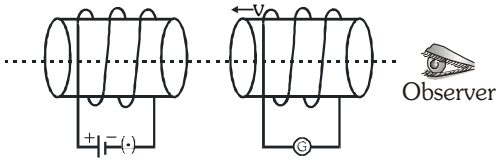
(2) Coil may be connected with an open circuit

(3) Coil must be of conducting nature

(4) Induced emf does not depends upon resistance of the coil

**EM0005**

**6.** The current flows in a circuit as shown below. If a second circuit is brought near the first circuit then the current in the second circuit will be :-




(1) Clock wise

(2) Anti clock wise

(3) Depending on the value of $R_G$

(4) None of the above

**EM0006**

**7.** A coil of resistance 10Ω and 1000 turns have the magnetic flux line of $5.5 \times 10^{-4}$ Wb. If the magnetic flux changed to $5 \times 10^{-4}$ Wb. in 0.1 sec, then the induced charge in coil is :–

(1) 50 μC (2) 5 μC

(3) 2 μC (4) 20 μC

**EM0007**

**8.** 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

**EM0008**

**9.** 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

**EM0010**

**10.** The magnetic flux in a coil of 100 turns increases by $12 \times 10^3$ 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

**EM0011**

**11.** A closed coil consists of 500 turns on a rectangular frame of area 4.0 $cm^2$ and has a resistance of 50 ohms. The coil is kept with its plane perpendicular to a uniform magnetic field of 0.2 $wb/m^2$, the amount of charge flowing through the coil if it is turned over (rotated through 180°):-

(1) $1.6 \times 10^{-3}$ C

(2) $16 \times 10^{-3}$ C

(3) $0.16 \times 10^{-3}$ C

(4) $160 \times 10^{-3}$ C

**EM0012**

**12.** A coil of mean area 500 $cm^2$ and having 1000 turns is held perpendicular to a uniform field of 0.4 gauss. The coil is turned through 180° in $\frac{1}{10}$ second. The average induced e.m.f. :–

(1) 0.04 V (2) 0.4 V

(3) 4 V (4) 0.004 V

**EM0013**

**13.** An emf induced in a coil, the linking magnetic flux

(1) Must decrease

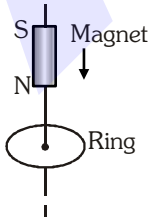
(2) Must increase

(3) Must remain constant

(4) Can be either increased or decreased

**EM0014**

**14.** Consider a metal ring kept on a horizontal plane. A bar magnet is held above the ring with its length along the axis of the ring. If the magnet is dropped freely the accelration of the falling magnet is (g is accelration due to gravity) :-




(1) More than g

(2) Equal to g

(3) Less than g

(4) Depend on mass of magnet

**EM0015**

**15.** An electron beam is moving near to a conducting loop then the induced current in the loop :-

(1) clockwise

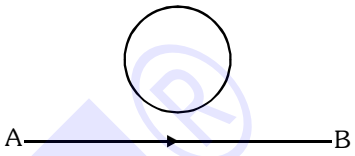
(2) anticlockwise

(3) both

(4) no current

**EM0016**

**16.** 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

**EM0017**

**17.** Faraday law represents :-

(1) relation between I and B

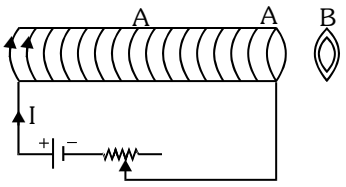
(2) relation between magnetic force and magnetic field

(3) relation between e.m.f and rate of change of flux

(4) none of these

**EM0018**

**18.** 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

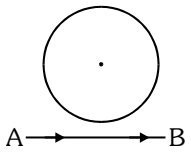
(2) Whether I increases or decreases, B will not experience any force

(3) If I increases, A will repel B

(4) If I increases, A will attract B

**EM0019**

**19.** A charge particle moves along the line AB, which lies in the same plane of a circular loop of conducting wire as shown in the fig. Then :-




(1) No current will be induced in the loop

(2) The current induced in the loop will change its direction as the charged particle passes by

(3) The current induced will be anticlockwise

(4) The current induced, will be clockwise

**EM0020**

**20.** The magnetic flux through a circuit of resistance R changes by an amount $\Delta\phi$ in a time $\Delta t$. The total quantity of electric charge Q that passes any point in the circuit during the time $\Delta t$ 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) $Q = \frac{1}{R} \cdot \frac{\Delta\phi}{\Delta t}$

**EM0021**

**21.** 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

**EM0022**

**22.** A circular loop of radius r is placed in a region where magnetic field increases with respect to time as B(t) = at then induced emf in coil :-

(1) $\pi r^2 a$ (2) $3\pi r^2 a$

(3) $2\pi r^2 a$ (4) $4\pi r^2 a$

**EM0023**

**23.** A circular loop of radius r is moved away from a current carrying wire then induced current in circular loop

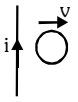
will be :-

(1) Clock wise

(2) Anti clockwise

(3) Not induced

(4) None of them




**EM0024**

## SELF INDUCTION AND L–R DC CIRCUIT

**24.** 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 inducing current

**EM0025**

**25.** 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 reach to 1/4th of the maximum value?

(1) 3.5 sec (2) 2.5 sec

(3) 5.5 sec (4) 7.5 sec

**EM0026**

**26.** An inductance coil have the time constant 4 sec, if it is cut into two equal parts and connected parallel then new time constant of the circuit :-

(1) 4 sec (2) 2 sec

(3) 1 sec (4) 0.5 sec

**EM0027**

**27.** Which statement is correct from following –

(a) Inductor store energy in the form of magnetic field

(b) Capacitor store energy in the form of electric field

(c) Inductor store energy in the form of electric and magnetic field both

(d) Capacitor store energy in the form of electric and magnetic field both

(1) a, b (2) a, c

(3) b, d (4) b, c

**EM0028**

**28.** If a current of 2A give rise a magnetic flux of $5 \times 10^{-5}$ weber/turn through a coil having 100 turns, then the magnetic energy stored in the medium surrounding by the coil is :-

(1) 5 joule (2) $5 \times 10^{-7}$ joule

(3) $5 \times 10^{-3}$ joule (4) 0.5 joule

**EM0029**

**29.** For a solenoid keeping the turn density constant its length makes halved and its cross section radius is doubled then the inductance of the solenoid increased by :–

(1) 200% (2) 100%

(3) 800% (4) 700%

**EM0030**

**30.** A constant current i maintained in a solenoid. Which of the following quantities will increase if an iron rod is inserted in the solenoid along its axis:-

(a) Magnetic field at the centre

(b) Magnetic flux linked with the solenoid

(c) Self inductance of the solenoid

(d) Rate of Joule heating

(1) a, b, c (2) c, d

(3) a, b (4) Only b

**EM0031**

**31.** The inductance of a solenoid is 5 henery and its resistance is 5Ω. If it is connected to a 10 volt battery then time taken by the current to reach $9/10^{th}$ of its maximum will be :-

(1) 4.0 s (2) 2.3 s

(3) 1.4 s (4) 1.2 s

**EM0032**

**32.** An LR circuit with a battery is connected at t = 0. Which of the following quantities is not zero just after the connection :-

(a) Current in circuit

(b) Magnetic potential energy in the inductor

(c) Power delivered by the battery

(d) Emf induced in the inductor

(1) a, b (2) a, c

(3) c, d (4) Only d

**EM0033**

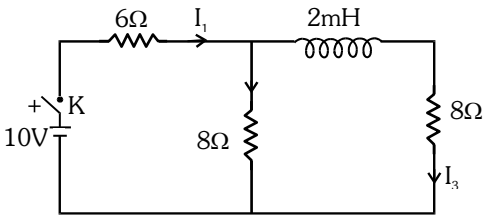
**33.** During 0·1 s current in a coil increases from 1A to 1·5 A. If inductance of this coil is 60 μH, induced current in external resistance of 600 μΩ is :-

(1) 1A (2) 4/3 A

(3) 2/3 A (4) 1/2 A

**EM0034**

**34.** In the circuit shown in figure what is the value of $I_1$ just after pressing the key K ?

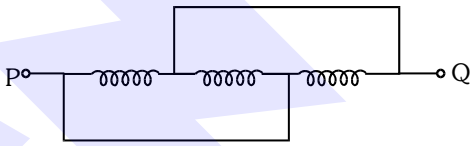



(1) $\frac{5}{7}$A (2) $\frac{5}{11}$A

(3) 1A (4) None of the above

**EM0035**

**35.** Pure inductors each of inductance 3 H are connected as shown. The equivalent induction of the circuit is :-




(1) 1H (2) 2H

(3) 3H (4) 9H

**EM0036**

**36.** The time constant of an iductance coil is $2.0 \times 10^{-3}$ s. When a 90 Ω resistance is joined in series, the time constant becomes $0.5 \times 10^{-3}$ s. The inductance and resistance of the coil are :-

(1) 30 mH ; 30 Ω (2) 30 mH ; 60Ω

(3) 60 mH ; 30Ω (4) 60mH ; 60Ω

**EM0037**

**37.** A cylindrical iron core supports N turns. If a current I produces a magnetic flux ϕ across the core's cross section, then the magnetic energy is :-

(1) Iϕ (2) $\frac{1}{2}$Iϕ

(3) $\frac{I^2\phi}{2}$ (4) $I^2\phi$

**EM0039**

**38.** The self inductance of a toroid is :-

(1) $\frac{\mu_0 N^2 r^2}{2 R_m}$ (2) $\frac{\mu_0 N^2 \pi r}{2R_m}$

(3) $\frac{\mu_0 N^2 r}{2R_m}$ (4) $\frac{\mu_0 N^2 r\pi}{R_m}$

**EM0040**

**39.** An inductance L and a resistance R are joined to a battery. After some time, battery is disconnected but L and R remains connected to the closed circuit. The current strength will be reduced to 37% of its initial value in :

(1) RL sec (2) R/L sec

(3) L/R sec (4) 1/LR sec

**EM0041**

**40.** Energy is stored in the choke coil in the form of:-

(1) Heat

(2) Electric field

(3) Magnetic field

(4 )Electro-magnetic field

**EM0042**

**41.** 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

**EM0043**

**42.** 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

**EM0044**

**43.** Two conducting coils are placed co-axially now a cell is connected in one coil then they will :-

(1) attract to each other

(2) repel to each other

(3) both (1) & (2)

(4) they will not experience any force

**EM0045**

**44.** 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

**EM0046**

**45.** The energy density in magnetic field B is proportional to :-

(1) $\frac{1}{B}$ (2) $\frac{1}{B^2}$ (3) B (4) $B^2$

**EM0047**

**46.** 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

**EM0048**

**47.** 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) $\frac{1}{5}$ sec (2) 40 sec

(3) 20 sec (4) 5 sec

**EM0049**

**48.** 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

**EM0050**

**49.** 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

**EM0051**

**50.** An ideal coil of 10H is connected in series with a resistance of 5Ω and a battery of 5V. 2 seconds after the connection is made, the current flowing in amperes in the circuit is :-

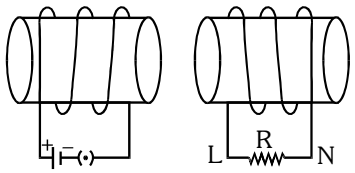
(1) $e$ (2) $e-1$

(3) $(1-e^{-1})$ (4) $(1-e)$

**EM0052**

## MUTUAL INDUCTION, TRANSFORMER AND EDDY CURRENTS

**51.** Two co–axial solenoids shown in figure. If key of primary suddenly opened then direction of instantaneous induced current in resistance 'R' which connected in secondary:

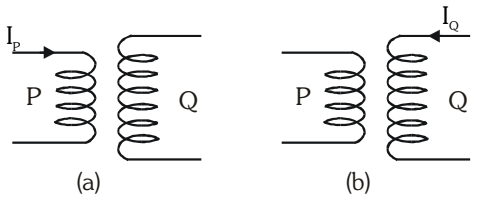



(1) L to N (2) N to L

(3) Alternating (4) Zero

**EM0053**

**52.** In figure (a) and figure (b) two air–cored solenoids P and Q have been shown. They are placed near each other. In figure (a), when $I_P$, the current in P, changes at the rate of 5 $As^{-1}$, an emf of 2 mV is induced in Q. The current in P is then switched off, and a current changing at 2 A $s^{-1}$ is fed through Q as shown in diagram. What emf will be induced in P:-




(1) $8 \times 10^{-4}$ V (2) $2 \times 10^{-8}$ V
(3) $5 \times 10^{-3}$ V (4) $8 \times 10^{-2}$ V

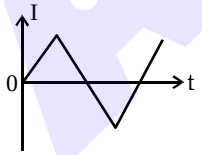
**EM0054**

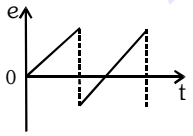
**53.** A small square loop of wire of side $\ell$ is placed inside a large square loop of wire of side L(L >> $\ell$). The loops are coplanar and their centres coincide. The mutual inductance of the system is proportional to:-

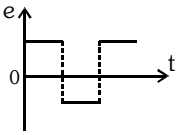
(1) $\frac{\ell}{L}$ (2) $\frac{\ell^2}{L}$
(3) $\frac{L}{\ell}$ (4) $\frac{L^2}{\ell}$

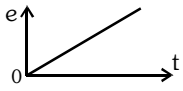
**EM0055**

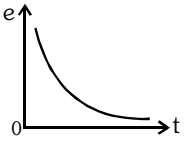
**54.** A current time curve is shown in the following diagram. This type of current is passed in the primary coil of transformer. The nature of induced emf in the secondary coil will be :-




(1) 


(2) 


(3) 


(4) 


**EM0056**

**55.** Two coil have a mutual inductance 0.005 H. The current changes in first coil according to equation $I = I_0 \sin \omega t$, where $I_0$ = 2A and $\omega = 100\pi$ rad/sec. The maximum value of induced emf in second coil is :-

(1) $4\pi$ V (2) $3\pi$ V
(3) $2\pi$ V (4) $\pi$ V

**EM0057**

**56.** The electric power is transferred to a far distance at high potential because:-

(1) It stops the wire theft
(2) To minimise power loss
(3) Generator gives only high potential
(4) Electric power is transferred early due to high potential

**EM0058**

**57.** If primary winding of a transformer were connected to a battery, the current in it will :-

(1) Increase (2) Remain constant
(3) Decrease (4) First (1) then (3)

**EM0059**

**58.** Which type of losses does not occur in transformer:-

(1) mechanical losses
(2) copper losses
(3) hysteresis losses
(4) eddy current losses

**EM0060**

**59.** The efficiency of a transformer is maximum, because :–

(1) No part of the transformer is in motion
(2) It creates maximum voltage
(3) It creates minimum voltage
(4) None of the above

**EM0061**

**60.** In order to avoid eddy currents in the core of a transformer :-

(1) The number of turns in the secondary coil is made considerably large
(2) A laminated core is used
(3) A step down transformer is used
(4) A high voltage alternating weak current is used

**EM0062**

**61.** The mutual inductance of two coils when magnetic flux changes by $2 \times 10^{-2}$ Wb and current changes by 0.01 A is :-

(1) 2 H (2) 3 H

(3) 4 H (4) 8 H

**EM0063**

**62.** Primary winding and secondary winding of a transformer has 100 and 300 turns respectively. If its input power is 60 W then output power of the transformer will be:-

(1) 240 W (2) 180 W

(3) 60 W (4) 20 W

**EM0064**

**63.** The ratio of the secondary to the primary turns in a transformer is 3 : 2 and the output power is P. Neglecting all power losses, the input power must be :-

(1) $\frac{P}{2}$ (2) P (3) $\frac{2P}{3}$ (4) $\frac{3P}{2}$

**EM0065**

**64.** 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) $M_{12} = \sqrt{L_1 / L_2}$

**EM0066**

**65.** In transformer, power of secondary coil is:-

(1) less than primary coil

(2) more than primary coil

(3) more in step up and less in step down than primary coil

(4) more in step down and less in step up than primary coil

**EM0067**

**66.** If the input voltage of a transformer is 2500 volts and output current is 80 ampere. The ratio of number of turns in the primary coil to that in secondary coil is 20 : 1. If efficiency of transformer is 100%, then the voltage in secondary coil is :

(1) $\frac{2500}{20}$ volt (2) $2500 \times 20$ volt

(3) $\frac{2500}{80 \times 20}$ volt (4) $\frac{2500 \times 20}{80}$ volt

**EM0068**

**67.** A step up transformer has turn ratio 10:1 . A cell of e.m.f. 2 volts is fed to the primary. Secondary voltage developed is :-

(1) 20 V (2) 10 V

(3) 2 V (4) Zero

**EM0069**

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

(1) 190 V (2) –190 V

(3) –10 V (4) 10 V

**EM0070**

**69.** Two coaxial solenoids are made by winding thin Cu wire over a pipe of cross-sectional area A = 10 $cm^2$ and length = 20 cm. If one of the solenoids has 300 turns and the other 400 turns, their mutual inductance is :-

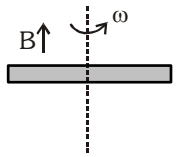
(1) $2.4\pi \times 10^{-5}$ H (2) $4.8\pi \times 10^{-4}$ H

(3) $4.8\pi \times 10^{-5}$ H (4) $2.4\pi \times 10^{-4}$ H

**EM0071**

## DYNAMIC & ROTATIONAL E.M.F. GENERATOR

**70.** A conducting rod of length $2\ell$ is rotating with constant angular speed $\omega$ about its perpendicular bisector. A uniform magnetic field $\vec{B}$ exists parallel to the axis of rotation. The emf induced between two ends of the rod is:-




(1) $B\omega\ell^2$ (2) $\frac{1}{2}B\omega\ell^2$

(3) $\frac{1}{8}B\omega\ell^2$ (4) Zero

**EM0072**

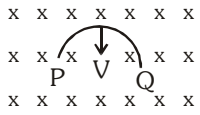
**71.** A conducting rod of 1m length rotating with a frequency of 50 rev/sec. about its one of end inside the uniform magnetic field of 6.28 mT. The value of induced emf between end of rod is :-

(1) 1 V (2) 2 V

(3) 0.5 V (4) 0.25 V

**EM0073**

**72.** A semicircle loop PQ of radius 'R' is moved with velocity 'v' in transverse magnetic field as shown in figure. The value of induced emf. between the ends of loop is :-




(1) Bv (πr), end 'P' at high potential

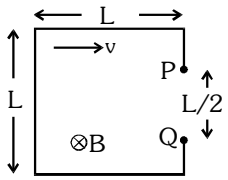
(2) 2 BRv, end P at high potential

(3) 2 BRv, end Q at high potential

(4) $B\frac{\pi R^2}{2}v$, end P at high potential

**EM0074**

**73.** The loop shown moves with a constant velocity 'v' in a uniform magnetic field of magnitude 'B' directed into the paper. The potential difference between P and Q is 'e':-




(1) $e = \frac{BLv}{2}$, Q is positive with respect to P

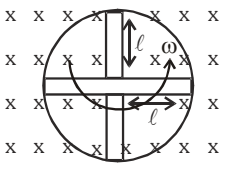
(2) $e = \frac{BLv}{2}$, P is positive with respect to Q

(3) $e = 0$

(4) $e = BLv$, Q is positive with respect to P

**EM0075**

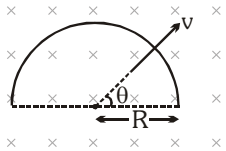
**74.** A conducting wheel in which there are four rods of lengthe $\ell$ as shown in figure is rotating with angular velocity ω in a uniform magnetic field B. The induced potential difference between its centre and rim will be :




(1) $2B\omega\ell^2$ (2) $\sqrt{B\ell^2\omega}$ (3) $\frac{B\ell\omega}{2}$ (4) $\frac{B\ell^2\omega}{2}$

**EM0076**

**75.** A semi circular loop of radius R is placed in a uniform magnetic field as shown. It is pulled with a constant velocity. The induced emf in the loop is :

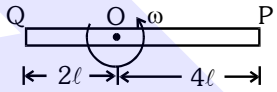



(1) Bv (πR) cosθ (2) Bv(pR) sinθ

(3) Bv(2R) cosθ (4) Bv(2R) sinθ

**EM0077**

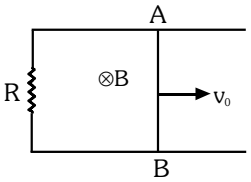
**76.** A conducting rod rotates with a constant angular velocity 'ω' about the axis which passes through point 'O' and perpendicular to its length. A uniform magnetic field 'B' exists parallel to the axis of the rotation. Then potential difference between the two ends of the rod is :




(1) $6B\omega\ell^2$ (2) $B\omega\ell^2$ (3) $10B\omega\ell^2$ (4) Zero

**EM0078**

**77.** Two long parallel metallic wires with a resistance 'R' form a horizontal plane. A conducting rod AB is on the wires shown in figure. The space has magnetic field pointing vertically downwards. The rod is given an initial velocity '$v_0$'. There is no friction in the wires and the rod. After a time 't' the velocity v of the rod will be such that:–




(1) $v > v_0$ (2) $v < v_0$

(3) $v = v_0$ (4) $v = -v_0$

**EM0079**

**78.** The armature coil of dynamo is rotating. The generated induced emf varies and the number of magnetic lines of force also varies. Which of the following condition is correct:-

(1) lines of flux will be minimum, but induced emf will be zero.

(2) lines of flux will be maximum, but the induced emf will be zero.

(3) lines of flux will be maximum, but induced emf will be not be zero.

(4) the lines of flux will be maximum, and the induced emf will be also maximum.

**EM0080**

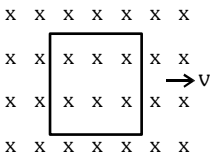
**79.** A conducting square loop of side $\ell$ and resistance R moves in its plane with a uniform velocity perpendicular to one of its sides. A uniform and constant magnetic field B exists along the perpendicular to the plane of the loop as shown in the figure. The current induced in the loop is:-

(1) $B\ell v/R$, clockwise

(2) $B\ell v/R$, anticlockwise

(3) $2\ B\ell v/R$, anticlockwise

(4) zero




**EM0081**

**80.** If the rotational velocity of a dynamo armature is doubled, then induced e.m.f will become :-

(1) half (2) two times

(3) four times (4) unchanged

**EM0082**

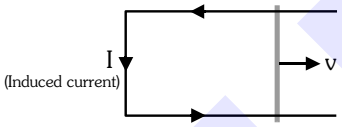
**81.** Dynamo which produces electricity, is a source of:

(1) gravity (2) magnetism

(3) e.m.f. (4) electrolysis

**EM0083**

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




(1) towards right (2) towards left

(3) vertically upward (4) vertically downward

**EM0084**

**83.** A metallic disc of radius 'R' is rotating about its geometrical axis with constant angular speed 'ω' in external magnetic field B which is perpendicular to the plane of the disc then induced emf between the centre and any peripherical point of the disc is given by :-

(1) $\pi\omega BR^2$ (2) $\omega BR^2$

(3) $\frac{\pi\omega BR^2}{2}$ (4) $\frac{\omega BR^2}{2}$

**EM0085**

**84.** Which of the following is correct for periodic electromagnetic induction :-

(1) maximum flux, zero emf

(2) zero flux, maximum emf

(3) zero flux, zero emf

(4) (1) & (2) both

**EM0086**

**85.** Dynamo is based on the principle of :-

(1) electro magnetic induction

(2) induced current

(3) induced magnetism

(4) Faraday effect

**EM0087**

**86.** Phase difference between induced emf and flux for a coil rotating in magnetic field :-

(1) 0 (2) $\pi/2$

(3) $\pi$ (4) $2\pi$

**EM0088**

**87.** In an AC generator, a coil with N turns, all of the same area A and total resistance R, rotates with frequency ω in a magnetic field B. The maximum value of emf generated in the coil is :-

(1) NABω (2) NABRω

(3) NAB (4) NABR

**EM0089**

**88.** The electric generator produce electric current based on which principle :-

(1) Ohm's law

(2) Faraday's law of EMI

(3) Ampere's law

(4) Biot - savart's law

**EM0090**

**89.** 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:-

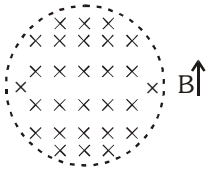
(1) $BA\omega\cos\omega t$ (2) $BA\omega\sin\omega t$

(3) $-BA\omega\sin\omega t$ (4) $-BA\omega\cos\omega t$

**EM0091**

## INDUCED ELECTRIC FIELD

**90.** In this given figure if magnetic field increases with time then pattern of induced electric field lines will be :-




(1) A.C.W. concentric circular field lines in the plane of the paper

(2) C.W. concentric circular field lines in the plane of the paper

(3) A.C.W. concentric circular field lines, perpendicular to the plane of the paper

(4) C.W. concentric circular field lines, perpendicular to the plane of the paper

**EM0092**

**91.** A nonconducting circular ring of radius 4 cm is placed in a time varing magnetic field with rate of 0.2T/s. If 2C charge placed at its circumference then electric force on this charge will be :-

(1) $4 \times 10^{-3}$ N

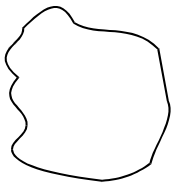
(2) $8 \times 10^{-3}$ N

(3) $6 \times 10^{-2}$ N

(4) $8 \times 10^{-2}$ N

**EM0093**

**92.** 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

**EM0094**

## EXERCISE-I (Conceptual Questions) ANSWER KEY

| Que. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ans. | **2** | **1** | **2** | **2** | **3** | **2** | **2** | **4** | **1** | **1** | **1** | **1** | **4** | **3** | **4** |
| Que. | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| Ans. | **4** | **3** | **3** | **2** | **1** | **3** | **1** | **1** | **2** | **1** | **1** | **1** | **3** | **2** | **1** |
| Que. | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 |
| Ans. | **2** | **4** | **4** | **1** | **1** | **3** | **2** | **1** | **3** | **3** | **2** | **2** | **2** | **4** | **4** |
| Que. | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 |
| Ans. | **4** | **4** | **3** | **3** | **3** | **1** | **1** | **2** | **2** | **4** | **2** | **2** | **1** | **1** | **2** |
| Que. | 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 | 74 | 75 |
| Ans. | **1** | **3** | **2** | **3** | **1** | **1** | **4** | **3** | **4** | **4** | **1** | **3** | **2** | **4** | **4** |
| Que. | 76 | 77 | 78 | 79 | 80 | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 |
| Ans. | **1** | **2** | **2** | **4** | **2** | **3** | **4** | **4** | **4** | **1** | **2** | **1** | **2** | **2** | **1** |
| Que. | 91 | 92 | | | | | | | | | | | | | |
| Ans. | **2** | **1** | | | | | | | | | | | | | |

## EXERCISE-II (Previous Year Questions) AIPMT/NEET

### AIPMT 2006

**1.** Two coils of self inductances 2 mH and 8 mH are placed so close together that the effective flux in one coil is completely linked with the other. The mutual inductance between these coils is :-

(1) 10 mH (2) 6 mH
(3) 4 mH (4) 16 mH

**EM0095**

### AIPMT 2007

**2.** The primary and secondary coils of a transformer have 50 and 1500 turns respectively. If the magnetic flux $\phi$ linked with the primary coil is given by $\phi = \phi_0 + 4t$, where $\phi$ is in webers, t is time in seconds and $\phi_0$ is a constant, the output voltage across the secondary coil is :

(1) 30 volts (2) 90 volts
(3) 120 volts (4) 220 volts

**EM0097**

**3.** A transformer is used to light a 100 W and 110V lamp from a 220 V mains. If the main current is 0.5 amp, the efficiency of the transformer is approximately :-

(1) 10% (2) 30%
(3) 50% (4) 90%

**EM0098**

### AIPMT 2008

**4.** A circular disc of radius 0.2 meter is placed in a uniform magnetic field of $\frac{1}{\pi}$ wb/m$^2$ in such way that its axis makes an angle of 60° with $\vec{B}$. The magnetic flux linked with the disc is :-

(1) 0.08 wb (2) 0.01 wb
(3) 0.02 wb (4) 0.06 wb

**EM0099**

**5.** A long solenoid has 500 turns. When a current of 2 ampere is passed through it, the resulting magneticflux linked with each turn of the solenoid is $4 \times 10^{-3}$ wb. The self–inductance of the solenoid is :-

(1) 1.0 henry (2) 4.0 henry
(3) 2.5 henry (4) 2.0 henry

**EM0100**

### AIPMT 2009

**6.** 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

**EM0101**

**7.** 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 $\pi$ $\mu$V (2) 3.2 $\pi$ $\mu$V
(3) 4.8 $\pi$ $\mu$V (4) 0.8 $\pi$ $\mu$V

**EM0102**

### AIPMT (Pre) 2010

**8.** A conducting circular loop is placed in a uniform magnetic field, B = .025 T with its plane perpendicular to the loop. The radius of the loop is made to shrink at a constant rate of 1 mm s$^{-1}$. The induced e.m.f. when the radius is 2 cm, is :-

(1) 2 $\mu$V (2) 2$\pi\mu$V (3) $\pi\mu$V (4) $\frac{\pi}{2}\mu$V

**EM0103**

### AIPMT (Pre) 2012

**9.** A coil of resistance 400Ω is placed in a magnetic field. If the magnetic flux $\phi$(Wb) linked with the coil varies with time t (sec) as

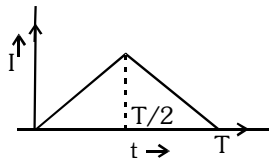
$\phi = 50t^2 + 4$.

The current in the coil at t = 2 sec is :

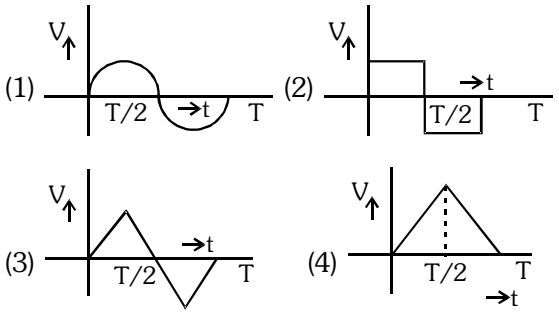
(1) 2A (2) 1A (3) 0.5A (4) 0.1A

**EM0105**

**10.** The current (I) in the inductance is varying with time according to the plot shown in figure.



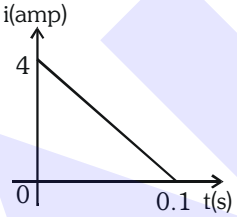

Which one of the following is the correct variation of voltage with time in the coil ?




**EM0106**

**AIPMT (Mains) 2012**

**11.** 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

**EM0107**

**NEET-UG 2013**

**12.** A wire loop is rotated in magnetic field. The frequency of change of direction of the induced e.m.f. is :

(1) Six times per revolution

(2) Once per revolution

(3) twice per revolution

(4) four times per revolution

**EM0108**

**AIPMT 2014**

**13.** A transformer having efficiency of 90% is working on 200V and 3kW power supply. If the current in the secondary coil is 6A, the voltage across the secondary coil and the current in the primary coil respectively are :-

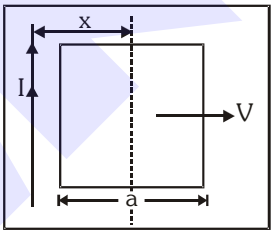
(1) 300 V, 15A (2) 450 V, 15A

(3) 450V, 13.5A (4) 600V, 15A

**EM0109**

**AIPMT 2015**

**14.** A conducting square frame of side 'a' and a long straight wire carrying current I are located in the same plane as shown in the figure. The frame moves to the right with a constant velocity 'V'. The emf induced in the frame will be proportional to:



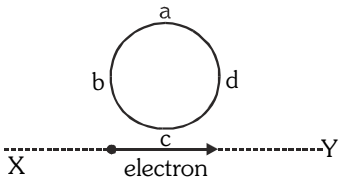

(1) $\frac{1}{(2x-a)^2}$ (2) $\frac{1}{(2x+a)^2}$

(3) $\frac{1}{(2x-a)(2x+a)}$ (4) $\frac{1}{x^2}$

**EM0111**

**Re-AIPMT 2015**

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




(1) No current induced

(2) abcd

(3) adcb

(4) The current will reverse its direction as the electron goes past the coil

**EM0112**

**NEET-I 2016**

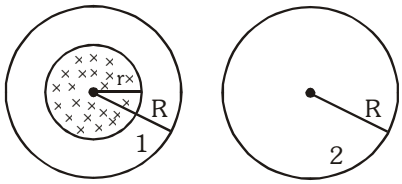
**16.** A long solenoid has 1000 turns. When a current of 4A flows through it, the magnetic flux linked with each turn of the solenoid is $4 \times 10^{-3}$ Wb. The self inductance of the solenoid is :-

(1) 4H (2) 3H (3) 2H (4) 1H

**EM0116**

**NEET-II 2016**

**17.** A uniform magnetic field is restricted within a region of radius r. The magnetic field changes with time at a rate $\frac{d\vec{B}}{dt}$. Loop 1 of radius R > r encloses the region r and loop 2 of radius R is outside the region of magnetic field as shown in the figure below. Then the e.m.f. generated is :-




(1) $-\frac{d\vec{B}}{dt}\pi R^2$ in loop 1 and zero in loop 2

(2) $-\frac{d\vec{B}}{dt}\pi r^2$ in loop 1 and zero in loop 2

(3) Zero in loop 1 and zero in loop 2

(4) $-\frac{d\vec{B}}{dt}\pi r^2$ in loop 1 and $-\frac{d\vec{B}}{dt}\pi r^2$ in loop 2

**EM0117**

**NEET(UG) 2017**

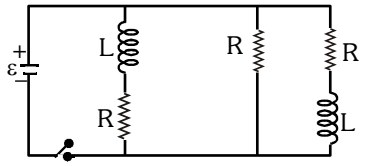
**18.** A long solenoid of diameter 0.1 m has $2 \times 10^4$ turns per meter. At the centre of the solenoid, a coil of 100 turns and radius 0.01 m is placed with its axis coinciding with the solenoid axis. The current in the solenoid reduces at a constant rate to 0A from 4 A in 0.05 s. If the resistance of the coil is $10\pi^2\Omega$. the total charge flowing through the coil during this time is :-

(1) 16 μC (2) 32 μC

(3) 16 π μC (4) 32 π μC

**EM0123**

**19.** Figure shows a circuit that contains three identical resistors with resistance R = 9.0 Ω each, two identical inductors with inductance L = 2.0 mH each, and an ideal battery with emf ε = 18 V. The current 'i' through the battery just after the switch closed is,..... :-




(1) 0.2 A (2) 2 A

(3) 0 ampere (4) 2 mA

**EM0124**

**NEET(UG) 2018**

**20.** The magnetic potential energy stored in a certain inductor is 25 mJ, when the current in the inductor is 60 mA. This inductor is of inductance :-

(1) 0.138 H (2) 138.88 H

(3) 1.389 H (4) 13.89 H

**EM0128**

**NEET(UG) 2019**

**21.** A 800 turn coil of effective area 0.05 $m^2$ is kept perpendicular to a magnetic field $5 \times 10^{-5}$ T. When the plane of the coil is rotated by 90° around any of its coplanar axis in 0.1 s, the emf induced in the coil will be :

(1) 2 V (2) 0.2 V

(3) $2 \times 10^{-3}$ V (4) 0.02 V

**EM0250**

**22.** In which of the following devices, the eddy current effect is **not** used ?

(1) induction furnace

(2) magnetic braking in train

(3) electromagnet

(4) electric heater

**EM0251**

**NEET(UG) 2019 (Odisha)**

**23.** A cycle wheel of radius 0.5 m is rotated with constant angular velocity of 10 rad/s in a region of magnetic field of 0.1 T which is perpendicular to the plane of the wheel. The EMF generated between its centre and the rim is,

(1) 0.25 V (2) 0.125 V

(3) 0.5 V (4) zero

**EM0252**

**NEET(UG) 2020 (Covid-19)**

**24.** The magnetic flux linked with a coil (in Wb) is given by the equation

$\phi = 5t^2 + 3t + 16$

The magnitude of induced emf in the coil at the fourth second will be

(1) 33 V (2) 43 V
(3) 108 V (4) 10 V

**EM0260**

**25.** A wheel with 20 metallic spokes each 1 m long is rotated with a speed of 120 rpm in a plane perpendicular to a magnetic field of 0.4 G. The induced emf between the axle and rim of the wheel will be, (1 G = $10^{-4}$ T)

(1) $2.51 \times 10^{-4}$ V (2) $2.51 \times 10^{-5}$ V
(3) $4.0 \times 10^{-5}$ V (4) 2.51 V

**EM0261**

**NEET(UG) 2021**

**26.** A step down transformer connected to an ac mains supply of 220 V is made to operate at 11V, 44 W lamp. Ignoring power losses in the transformer, what is the current in the primary circuit ?

(1) 0.2 A (2) 0.4 A
(3) 2A (4) 4A

**EM0262**

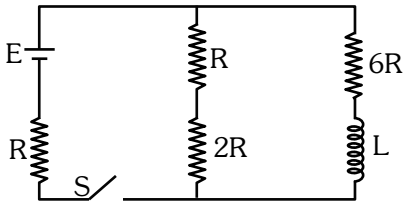
**27.** Two conducting circular loops of radii $R_1$ and $R_2$ are placed in the same plane with their centres coinciding. If $R_1 >> R_2$, the mutual inductance M between them will be directly proportional to:

(1) $\frac{R_1}{R_2}$ (2) $\frac{R_2}{R_1}$ (3) $\frac{R_1^2}{R_2}$ (4) $\frac{R_2^2}{R_1}$

**EM0263**

**NEET (UG) 2021(Paper-2)**

**28.** If switch is closed at t = 0, the current supplied by battery immediately after closing the switch is




(1) $\frac{E}{3R}$ (2) $\frac{E}{4R}$ (3) $\frac{E}{7R}$ (4) $\frac{E}{R}$

**EM0264**

**29.** In a circuit with coil of resistance 5 Ω, the magnetic flux changes from 20 Weber to 10 Weber in 0.1 second. The charge that flows in the coil during this time is

(1) 1 coulomb
(2) 2 coulomb
(3) 6 coulomb
(4) 4 coulomb

**EM0265**

**NEET (UG) 2022**

**30.** A square loop of side 1 m and resistance 1 Ω is placed in a magnetic field of 0.5 T. If the plane of loop is perpendicular to the direction of magnetic field, the magnetic flux through the loop is :

(1) 0.5 weber
(2) 1 weber
(3) Zero weber
(4) 2 weber

**EM0266**

**31.** The dimensions $[MLT^{-2} A^{-2}]$ belong to the :

(1) self inductance
(2) magnetic permeability
(3) electric permittivity
(4) magnetic flux

**EM0267**

**NEET (UG) 2022 (Overseas)**

**32.** The current in an inductor of self inductance 4 H changes from 4 A to 2 A in 1 second. The e.m.f. induced in the coil is:

(1) 2 V (2) –4 V
(3) 8 V (4) –2 V

**EM0268**

**33.** An inductor coil of self inductance 10 H carries a current of 1 A. The magnetic field energy stored in the coil is:

(1) 2.5 J (2) 20 J
(3) 5 J (4) 10 J

**EM0269**

**Re-NEET (UG) 2022**

**34.** The magnetic flux linked to a circular coil of radius R is :

$\phi = 2t^3 + 4t^2 + 2t + 5$ Wb

The magnitude of induced emf in the coil at t = 5s is:

(1) 108 V (2) 197 V

(3) 150 V (4) 192 V

**EM0270**

EXERCISE-II (Previous Year Questions) ANSWER KEY

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Que.** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| **Ans.** | **3** | **3** | **4** | **3** | **1** | **3** | **2** | **3** | **3** | **2** | **4** | **3** | **2** | **3** | **4** |
| **Que.** | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| **Ans.** | **4** | **2** | **2** | **2** | **4** | **4** | **4** | **2** | **2** | **1** | **1** | **4** | **2** | **2** | **1** |
| **Que.** | 31 | 32 | 33 | 34 | | | | | | | | | | | |
| **Ans.** | **2** | **3** | **3** | **4** | | | | | | | | | | | |

## EXERCISE-III (Analytical Questions) Master Your Understanding

**1.** A coil of copper wire is connected in series with a bulb, a battery and a switch. When the circuit is completed the bulb lights up immediately. The circuit is switched off and a rod of soft iron is placed inside the coil. On completing the circuit again. It is observed that :-

(1) Bulb is not so bright

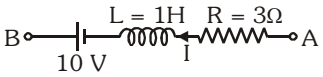
(2) There is a slight delay before bulb lights to its normal brightness

(3) The bulb is initially bright but gradually becomes dim

(4) The bulb is brighter than before

**EM0134**

**2.** In the branch AB of a circuit, as shown in the figure, a current I = (t + 2) A is flowing, where t is the time in second. At t = 0, the value of $(V_A - V_B)$ will be :-




(1) 3V (2) –3V (3) –5V (4) 5V

**EM0136**

**3.** An e.m.f. of 15 volt is applied in a circuit containing 5 henry inductance and 10 ohm resistance. The ratio of the currents at time $t \to \infty$ and at t = 1 second is:-

(1) $\frac{e^{1/2}}{e^{1/2}-1}$ (2) $\frac{e^2}{e^2-1}$

(3) $1-e^{-1}$ (4) $e^{-1}$

**EM0138**

**4.** If 2.2 kW power transmitts 22000 volts in a line of 10Ω resistance, the value of power loss will be:-

(1) 0.1 watt (2) 14 watts

(3) 100 watts (4) 1000 watts

**EM0139**

**5.** The bob of a simple pendulum is replaced by a magnet. The oscillation are set along the length of the magnet. A copper coil is added so that one pole of the magnet passes in and out of the coil. The coil is shortcircuited. Then which of the following happens ?

(1) period does not change

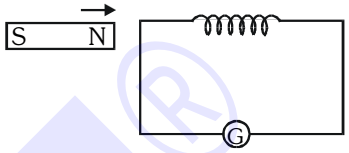
(2) oscillations are damped

(3) amplitude increases

(4) period decreases

**EM0140**

**6.** As shown is the figure, a magnet is brought towards a fixed coil. Due to this the induced emf, current and the charge are E, I and Q respectively. If the speed of the magnet is double then the following statement is wrong :–




(1) E increases

(2) I increases

(3) Q does not change

(4) Q increases

**EM0141**

**7.** 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

**EM0142**

**8.** When two co-axial coils having same current in same direction are brought close to each other then the value of current in both coils :-

(1) increase

(2) decrease

(3) first increases and then decrease

(4) remain same

**EM0143**

**9.** A magnet is dropped down an infinitely long vertical copper tube. Then

(1) The magnet moves with continuously decreasing velocity and ultimately comes to rest

(2) The magnet moves with continuosly increasing velocity and ultimately acquires a constant terminal velocity

(3) The magnet moves with continuously increasing velocity and acceleration.

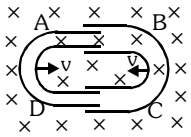
(4) The magnet moves with continuously increasing velocity but constant acceleration

**EM0144**

**10.** If a copper ring is moved quickly towards south pole of a powerful stationary bar magnet, then:-
(1) Current flows through the copper ring
(2) Voltage in the magnet increases
(3) Current flows in the magnet
(4) Copper ring will get magnetised

**EM0145**

**11.** 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 $\ell$ is the width of each tube:-



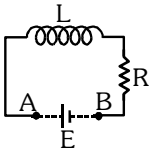

(1) $2B\ell v$ (2) Zero
(3) $-B\ell v$ (4) $B\ell v$

**EM0147**

**12.** Which of the following units denotes the dimensions $ML^2/Q^2$, where Q denotes the electric charge :-
(1) Weber (2) $Wb/m^2$
(3) henry (4) $H/m^2$

**EM0149**

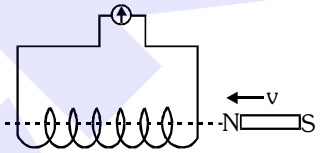
**13.** An inductor (L = 100 mH), a resistor (R = 100Ω) and a battery (E = 100 V) are initially connected in series as shown in the figure. After a long time the battery is disconnected after short circuiting the points A and B. The current in the circuit 1 ms after the short circuit is :-

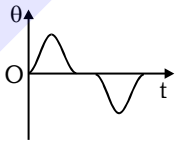


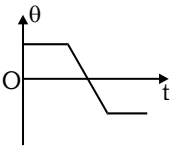

(1) 1A (2) $1/e$ A
(3) $e$ A (4) 0.1 A

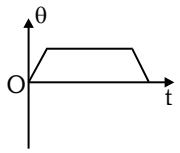
**EM0150**

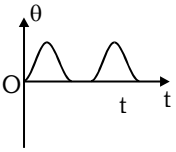
**14.** A short bar magnet passes at a steady speed right through a long solenoid. A galvanometer is connected across the solenoid. Which graph best represents the variation of the galvanometer deflection θ with time :-




(1) 


(2) 


(3) 


(4) 


**EM0009**

## EXERCISE-III (Analytical Questions) ANSWER KEY

| Que. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ans. | **2** | **2** | **2** | **1** | **2** | **4** | **1** | **2** | **2** | **1** | **1** | **3** | **2** | **1** |