

EMI

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LEVEL #1

Questions
based on

Induced EMF & Current

Q.1 The instantaneous flux associated with a closed circuit of 10Ω resistance is indicated by the following reaction $\phi = 6t^2 - 5t + 1$, then the value in amperes of the induced current at $t = 0.25$ sec will be-

- (A) 1.2 (B) 0.8
(C) 6 (D) 0.2

Q.2 A cylindrical bar magnetic is lying along the axis of a circular coil. If the magnet is rotated about the axis of the coil then-

- (A) e.m.f. will be induced in the coil
(B) Only induced current will be generated in the coil
(C) No current will be induced in the coil
(D) Both e.m.f. and current will be induced in the coil

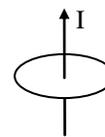
Q.3 When a coil of area 2 cm^2 and having 30 turns, whose plane is normal to the magnetic field, is drawn out of the magnetic field, a charge of 1.5×10^{-4} coulomb flows in the circuit. If its resistance is 40 ohm, then the magnetic flux density in Tesla will be –

- (A) 10 (B) 0.1 (C) 1 (D) 0.01

Q.4 When a magnet is being moved towards a coil, the induced emf does not depend upon-

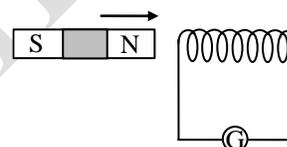
- (A) the number of turns of the coil
(B) the motion of the magnet
(C) the magnetic moment of the magnet
(D) the resistance of the coil

Q.5 A wire carrying current I , lie on the axis of a conducting ring. The direction of the induced current in the ring, when I is decreasing at a steady rate is-



- (A) clockwise
(B) anticlockwise
(C) alternatively clock and anticlockwise
(D) no induced current flow in the ring

Q.6 A magnet is brought towards a fixed coil rapidly. Due to this induced emf, current and charge are E , I and Q respectively. If the speed of the magnet is doubled, then wrong statement is-



- (A) E increases
(B) I increases
(C) Q remains unchanged
(D) Q increases

Q.7 A field of $2 \times 10^{-2} \text{ T}$ acts at right angles to a coil of 50 turns of area 10^{-2} m^2 . The coil is removed from the field in 0.1 second. Then the induced emf in the coil is-

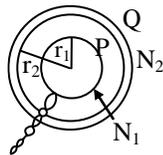
- (A) 0.1 V (B) 80 KV
(C) 7.96 V (D) none of the above

Q.8 A coil having n turns and area A is initially placed with its plane normal to the magnetic field B . It is then rotated through 180° in 0.2 sec. The emf induced at the ends of the coils is-

- (A) 0.1 nAB (B) nAB
(C) 5 nAB (D) 10 nAB

- Q.9** A conducting circular loop is placed in a uniform magnetic field $B = 40 \text{ mT}$ with its plane perpendicular to the field. If the radius of the loop starts shrinking at a constant rate of 2 mm/s , then the induced emf in the loop at an instant when its radius is 1.0 cm is -
- (A) $0.1 \pi \mu \text{ V}$ (B) $0.2 \pi \mu \text{ V}$
 (C) $1.0 \pi \mu \text{ V}$ (D) $1.6 \pi \mu \text{ V}$

- Q.10** Two plane circular coils P and Q have radii r_1 and r_2 , respectively, ($r_1 \ll r_2$) and are coaxial as shown in fig. The number of turns in P and Q are respectively N_1 and N_2 . If current in coil Q is varied steadily at a rate x ampere/sec then the induced emf in the coil P will be approximately-



- (A) $\mu_0 N_1 N_2 \pi r_1^2$
 (B) $\mu_0 N_1 N_2 \pi r_1^2 x$
 (C) $\mu_0 N_1 N_2 \pi r_1^2 x / 2r_2$
 (D) 0
- Q.11** The rate of change of magnetic flux density through a circular coil of area 10^{-2} m^2 and number of turns 100 is $10^3 \text{ Wb/m}^2/\text{s}$. The value of induced e.m.f. will be -
- (A) 10^{-2} V (B) 10^{-3} V
 (C) 10 V (D) 10^3 V
- Q.12** A magnet is moving towards the coil along the axis and the emf induced in the coil is ϵ . If the coil also starts moving towards the magnet with the same speed then induced emf will be-
- (A) $\epsilon/2$ (B) ϵ
 (C) 2ϵ (D) 4ϵ

- Q.13** A coil of cross-sectional area $5 \times 10^{-4} \text{ m}^2$ and having number of turns 1000 is placed perpendicular to a magnetic field of 10^{-2} T . The coil is connected to a galvanometer of resistance 500Ω . The induced charge generated in the coil on rotating it through an angle of π radian will be -
- (A) $10 \mu \text{ C}$ (B) $20 \mu \text{ C}$
 (C) $50 \mu \text{ C}$ (D) $100 \mu \text{ C}$

Questions based on

Magnetic flux

- Q.14** A flux of 1 m Wb passes through a strip having an area $A = 0.02 \text{ m}^2$. The plane of the strip is at an angle of 60° to the direction of a uniform field B . The value of B is-
- (A) 0.1 T (B) 0.058 T
 (C) 4.0 mT (D) none of the above
- Q.15** A small loop of area of cross section 10^{-4} m^2 is lying concentrically and coplanar inside a bigger loop of radius 0.628 m . A current of 10 A is passed in the bigger loop. The smaller loop is rotated about its diameter with an angular velocity ω . The magnetic flux linked with the smaller loop will be-
- (A) $10^{-7} \sin \omega t$ (B) $10^{-7} \cos \omega t$
 (C) $10^{-9} \sin \omega t$ (D) $10^{-9} \cos \omega t$
- Q.16** A coil of N turns and area A is rotated at the rate of n rotations per second in a magnetic field of intensity B , the magnitude of the maximum magnetic flux will be-
- (A) NAB (B) nAB
 (C) $NnAB$ (D) $2\pi nNAB$
- Q.17** The number of turns in a long solenoid is 500. The area of cross-section of solenoid is $2 \times 10^{-3} \text{ m}^2$. If the value of magnetic induction, on passing a current of 2 amp , through it is $5 \times 10^{-3} \text{ Tesla}$, the magnitude of magnetic flux connected with it in Webers will be-
- (A) 5×10^{-3} (B) 10^{-2}
 (C) 10^{-5} (D) 2.5

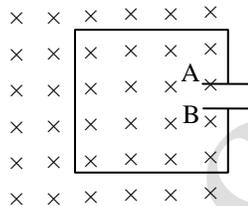
Q.18 Lenz's law is consistent with law of conservation of -

- (A) current (B) emf
(C) energy (D) all of the above

Q.19 The north pole of a magnet is brought near a coil. The induced current in the coil as seen by an observer on the side of magnet will be-

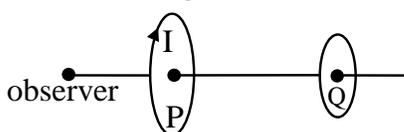
- (A) in the clockwise direction
(B) in the anticlockwise direction
(C) initially in the clockwise and then anticlockwise direction
(D) initially in the anticlockwise and then clockwise direction.

Q.20 A magnetic field is directed normally downwards through a metallic frame as shown in the figure. On increasing the magnetic field-



- (A) plate B will be positively charged
(B) plate A will be positively charged
(C) none of the plates will be positively charged
(D) all of the above

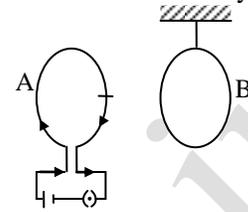
Q.21 Two coils P and Q are lying a little distance apart coaxially. If a current I is suddenly set up in the coil P then the direction of current induced in coil Q will be-



- (A) clockwise (B) towards north

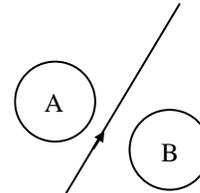
- (C) towards south (D) anticlockwise

Q.22 A system S consists of two coils A and B. The coil A carries a steady current I while the coil B is suspended near by as shown in fig. Now if the system is heated so as to raise the temperature of two coils steadily then-



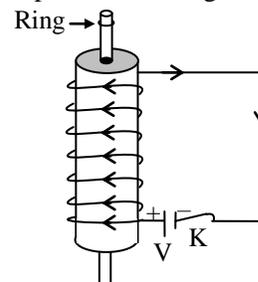
- (A) the two coils show attraction
(B) the two coils show repulsion
(C) there is no change in the position of the two coils
(D) induced currents are not possible in coil B.

Q.23 Consider the situation shown in fig. If the current I in the long straight wire XY is increased at a steady rate then the induced emf's in loops A and B will be -



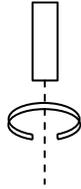
- (A) clockwise in A, anticlockwise in B
(B) anticlockwise in A, clockwise in B
(C) clockwise in both A and B
(D) anticlockwise in both A and B

Q.24 A conducting ring is placed around the core of an electromagnet as shown in fig. When key K is pressed, the ring-



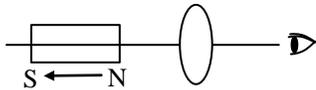
- (A) remains stationary
(B) is attracted towards the electromagnet
(C) jumps out of the core
(D) none of the above

- Q.25** A copper ring having a cut such as not to form a complete loop is held horizontally and a bar magnet is dropped through the ring with its length along the axis of the ring. Then acceleration of the falling magnet is- (neglect air friction)-



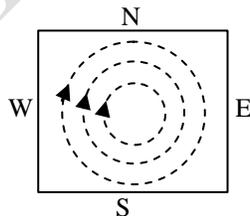
- (A) g (B) less than g
(C) more than g (D) 0

- Q.26** The north pole of a magnet is brought away from a coil, then the direction of induced current will be-



- (A) in the clockwise direction
(B) in the anticlockwise direction
(C) initially in the clockwise and then anticlockwise direction
(D) initially in the anticlockwise and then clockwise direction.

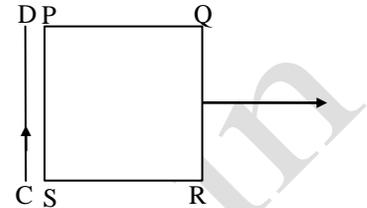
- Q.27** A metal sheet is placed in a variable magnetic field which is increasing from zero to maximum. Induced current flows in the directions as shown in figure. The direction of magnetic field will be-



- (A) normal to the paper, inwards
(B) normal to the paper, outwards.
(C) from east to west

(D) from north to south

- Q.28** A square loop PQRS is carried away from a current carrying long straight conducting wire CD. The direction of induced current in the loop will be-

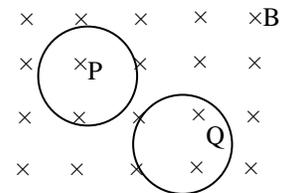


- (A) anticlockwise
(B) clockwise
(C) sometimes clockwise some times anticlockwise
(D) current will not be induced

- Q.29** A thin sheet of conductor, when allowed to oscillate in a magnetic field normal to the sheet, then the motion is-

- (A) damped due to air friction
(B) damped due to eddy currents
(C) accelerated due to eddy currents
(D) not effected by induced currents

- Q.30** P and Q are two circular thin coils of same radius and subjected to the same rate of change of flux. If coil P is made up of copper and Q is made up of iron, then the wrong statement is-



- (A) emf induced in the two coils is the same
(B) the induced current in P is more than that in Q
(C) the induced current in P and Q are in the same direction

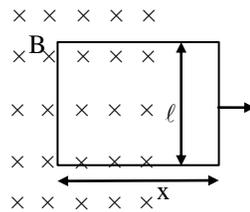
(D) the induced currents are the same in both the coils.

Questions based on Motional EMI

Q.31 A wire of length 4 m placed normal to the plane magnetic field of $(2\hat{i}+4\hat{j})$ Tesla is moving with a velocity $(4\hat{i}+6\hat{j}+8\hat{k})$ m/s. The emf induced across the ends of the wire will be-

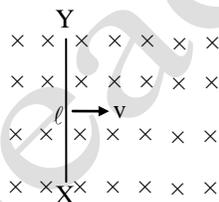
(A) 4 V (B) 8 V
(C) 16 V (D) 32 V

Q.32 A rectangular loop of resistance R, and sides l and x, is pulled out of a uniform magnetic field B with a steady velocity v. The necessary force F required for maintaining uniform velocity of withdrawal is-



- (A) $\frac{Bl^2v}{R}$ (B) $\frac{B^2l^2v}{R}$
(C) $\frac{B^2l^2v^2}{R}$ (D) 0

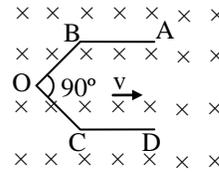
Q.33 A small conducting rod of length l , moves with a uniform velocity v in a uniform magnetic field B as shown in fig-



- (A) Then the end X of the rod becomes positively charged
(B) The end Y of the rod becomes positively charged
(C) The entire rod is unevenly charged
(D) The rod becomes hot due to joule heating.

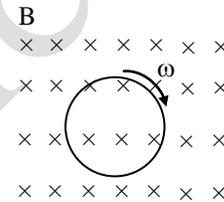
Q.34 A conductor ABCD moves along its bisector with a velocity of 1 m/s through a perpendicular magnetic field of 1 Wb/m^2 , as shown in fig. If all the four sides are of 1m

length each, then the induced emf between points A and D is-



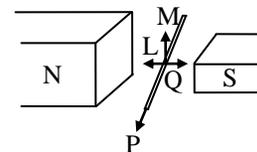
- (A) 0 (B) 1.41 volt
(C) 0.71 volt (D) none of the above

Q.35 A circular coil of radius r is placed in a uniform magnetic field B. The magnetic field is normal to the plane of the coil, as shown in fig. Now if the coil is rotated at an angular speed of ω , about its own axis, then the induced emf in the coil is-



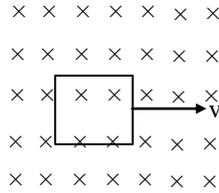
- (A) $\frac{BA\omega}{2\pi}$ (B) $B(2\pi r)\omega$
(C) 0 (D) None of the above

Q.36 An electric potential difference will be induced between the ends of the conductor shows in fig, when conductor moves in the direction-



- (A) P (B) Q (C) L (D) M

Q.37 A square conducting loop of side L and resistance R is moving with a uniform velocity at right angles to one of the sides in its own plane. On applying a uniform magnetic field at right angles to its plane as shown in the figure the induced current in the loop will be -



- (A) Zero
 (B) $\frac{BLv}{R}$ in anticlockwise direction
 (C) $\frac{BLv}{R}$ in clockwise direction
 (D) $\frac{2BLv}{R}$ in clockwise direction

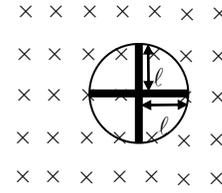
Q.38 A circular copper disc of radius 25 cm is rotating about its own axis with a constant angular velocity of 130 rad/s. If a magnetic field of 5×10^{-3} Tesla is applied at right angles to the disc, then the induced potential difference between the centre and the rim of the disc will approximately be –

- (A) 20×10^{-3} V (B) 20×10^{-6} V
 (C) 20×10^{-9} (D) Zero

Q.39 A 1.2m wide railway track is parallel to magnetic meridian. The vertical component of earth's magnetic field is 0.5 gauss. When a train runs on the rails at a speed of 60Km/hr, then the induced potential difference between the ends of its axle will be-

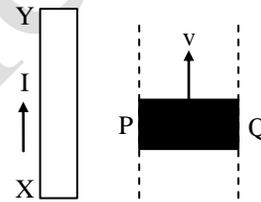
- (A) 10^{-4} V (B) 2×10^{-4} V
 (C) 10^{-3} V (D) Zero

Q.40 A conducting wheel in which there are four rods of length ℓ is rotating with angular velocity ω in a uniform magnetic field B. The induced potential difference between its centre and rim will be –



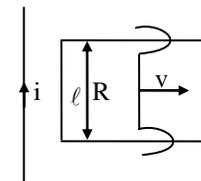
- (A) 0 (B) $B\ell^2\omega$
 (C) $B^2\ell\omega$ (D) $\frac{B\ell^2\omega}{2}$

Q.41 A small straight conductor PQ is lying at right angles to an infinite current carrying conductor XY. If the conductor PQ is displaced on metallic rails parallel to the conductor XY then which end will be at higher potential -



- (A) P
 (B) Q
 (C) Vertically downwards
 (D) Vertically upwards

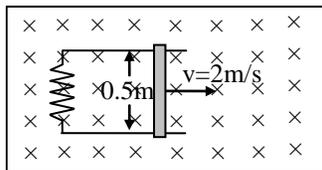
Q.42 A straight conductor carrying current i and a loop closed by a sliding connector of resistance R lie in the same plane. The connector slides towards right with a uniform velocity v . The induced current generated in the loop in terms of distance r of the connector from the straight conductor will be-



- (A) $\frac{\mu_0 i \ell v}{2\pi r}$ (B) $\frac{\mu_0 i \ell}{2\pi r}$
 (C) $\frac{\mu_0 i \ell v}{2\pi r R}$ (D) None of these

- Q.43** The spokes of a wheel are made of metal and their lengths are of one metre. On rotating the wheel about its own axis in a uniform magnetic field of 5×10^{-5} Tesla normal to the plane of wheel, a potential difference of 3.14 mV is generated between the rim and the axis. The rotational velocity of the wheel is-
- (A) 63 rev./s (B) 50 rev./s
(C) 31.4 rev./s (D) 20 rev./s

- Q.44** A metal rod completes a circuit as shown in the figure. The circuit is normal to a magnetic field $B = 0.15$ T. If the resistance of the circuit is 3 ohm then the force required to move the rod with a constant velocity of 2 m/s will be-



- (A) 3.75×10^{-3} N (B) 3.75×10^{-2} N
(C) 3.75×10^2 N (D) 3.75×10^{-4} N

Questions based on

Self & Mutual induction and combination of coils

- Q.45** The significance of self inductance L is the same as of that of in the linear motion-
- (A) mass (B) velocity
(C) acceleration (D) displacement
- Q.46** On making a circular coil of copper wire of length ℓ and coil radius r , the value of self inductance is obtained as L . If the coil of same wire, but of coil radius $r/2$, is made, the value of self inductance will be-
- (A) $2L$ (B) L (C) $4L$ (D) $L/2$
- Q.47** Out of the two coils placed near each other, when a current of 2 amp is passed in one, a flux of 6×10^{-5} Weber passes through the other. If the number of turns in the secondary coils is 20, the value of coefficient of mutual induction in the coils will be-
- (A) 6H (B) 6 mH

- (C) 0.6H (D) 0.6 mH

- Q.48** The coefficient of mutual induction between two coils is 4H. If the current in the primary reduces from 5A to zero in 10^{-3} second then the induced e.m.f. in the secondary coil will be-
- (A) 10^4 V (B) 25×10^3 V
(C) 2×10^4 V (D) 15×10^3 V

- Q.49** The coefficient of mutual induction between two closely lying coils does not depend upon-
- (A) their mutual orientation
(B) the permeability of their core material
(C) their structure
(D) the current flowing in them

- Q.50** The number of turns in a coil of wire of fixed radius is 600 and its self inductance is 108 mH. The self inductance of a coil of 500 turns will be-
- (A) 74 mH (B) 75 mH
(C) 76 mH (D) 77 mH

- Q.51** The value of the self inductance of a coil is 5 H. If the current in the coil changes steadily from 1A to 2A in 0.5 seconds, then the magnitude of induced emf is-
- (A) 1V (B) 10 V
(C) 100 V (D) 0.1 V

- Q.52** An inductance stores energy in-
- (A) electric field (B) magnetic field
(C) resistance of coils (D) all of the above

- Q.53** A thin copper wire of length 100 metres is wound as a solenoid of length ℓ and radius r . Its self inductance is found to be L . Now if the same length of wire is wound as a solenoid of length ℓ but of radius $r/2$, then its self inductance will be-
- (A) $4L$ (B) $2L$ (C) L (D) $L/2$

- Q.54** The coefficient of coupling between two coil is maximum when the two coils are-
- (A) placed at right angles
(B) placed parallel at close distance

- (C) wound around a common ferromagnetic core and insulated from it
 (D) placed at an angle of 45° with each other

Q.55 Two coils of self inductances L_1 and L_2 are tightly wrapped one over the other. The maximum mutual inductance of the combination will be-

(A) $L_1 + L_2$ (B) $L_1 L_2$
 (C) $\sqrt{L_1 L_2}$ (D) $\frac{L_1 L_2}{L_1 + L_2}$

Q.56 The coefficient of mutual inductance of the two coils is 5 H. The current through the primary coil is reduced to zero value from 3A in 1 milli second. The induced emf in the secondary coils is-

(A) 0 (B) 1.67 KV
 (C) 15 KV (D) 600 V

Q.57 The value of coefficient of mutual induction in two coils can be increased by-

(A) placing the coils mutually perpendicular.
 (B) keeping the coils near to each other.
 (C) keeping the coils considerably apart.
 (D) winding the core on the common iron magnetic material and insulating them.

Q.58 The current is reduced from 3 amp to zero in 0.001 sec. in the primary coil. It induces an emf of 15000 volts in the secondary. The value of coefficient of mutual inductance in Henry will be-

(A) 5 (B) 0.5 (C) 4.5 (D) 50

Q.59 A solenoid having a core of cross-section 4 cm^2 , half air and half iron (relative permeability = 500), is 22 cm long. If the number of turns on it is 10^3 its self inductance is-

(A) 570 H (B) 57 H
 (C) 5.7 H (D) 0.57 H

Q.60 The coefficients of self induction of two inductance coils are 0.01H and 0.03H respectively. When they are connected in series so as to support each other, then the resultant self inductance becomes 0.06 Henry. The value of coefficient of mutual induction will be-

(A) 0.02 H (B) 0.05 H
 (C) 0.01 H (D) zero

Q.61 Two identical solenoid coils, each of self inductance L are connected in series. Their turns are in the same sense, and the distance between them is such that the coefficient of coupling is half. Then the equivalent inductance of the combination is-

(A) L (B) 2L (C) 3L (D) L/2

Q.62 If two coils of negligible mutual induction and having coefficient of inductances L_1 and L_2 ($L_1 > L_2$) are arranged in parallel, the value of the equivalent self-induction will be-

(A) $L_1 L_2 / (L_1 - L_2)$ (B) $L_1 L_2 / (L_1 + L_2)$
 (C) $(L_1 + L_2) / L_1 L_2$ (D) $(L_1 - L_2) / L_1 L_2$

Questions based on

Growth & decay of current in coil

Q.63 The self inductance and resistance of a coil are 5H and 20Ω respectively. On applying an e.m.f. of 100 V on it, the magnetic potential energy stored in the coil will be-

(A) 62.5 Joule (B) 62.5 erg
 (C) 62.5×10^{-3} Joule (D) zero

Q.64 The energy stored in an inductance is 1 joule when a current of 0.1 A is established in it. The self-inductance of the coil is-

(A) 25 H (B) 50 H
 (C) 200 H (D) 2.6 H

Q.65 The growth of current in an L - R circuit in time $t = L / R$ is equal to about-

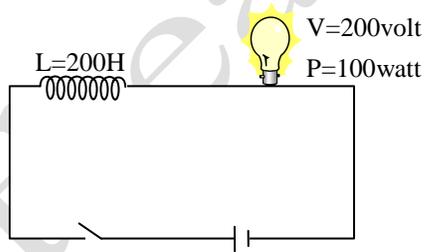
- (A) 37% of maximum
- (B) 63% of maximum
- (C) 57% of maximum
- (D) 67% of maximum

Q.66 The current in an L-R circuit in a time $t = 2L / R$ reduces to -
 (A) 36.5% of maximum
 (B) 13.5% of maximum
 (C) 0.50% of maximum
 (D) 63.2% of maximum

Q.67 A coil of 10 H inductance has a 5 Ω resistance and is connected to a 5 volt battery in series. The current in ampere in the circuit 2 seconds after the circuit is switched on is-
 (A) 1 amp (B) $(1 - 1/e)$ amp
 (C) $(1 - e)$ amp (D) $1/e$ amp.

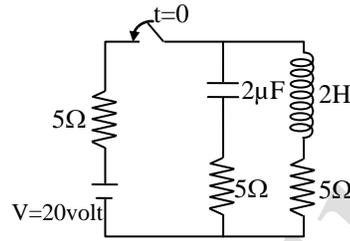
Q.68 A coil of resistance R and inductance L is connected to a battery of E volt e.m.f. This final current in the coil is-
 (A) E/R (B) E/L
 (C) $\sqrt{[E/(R^2 + L^2)]}$ (D) $\sqrt{[EL/(R^2 + L^2)]}$

Q.69 Calculate the ratio of power dissipated by the bulb at $t = 1$ sec and $t = 2$ sec after closing the switch-



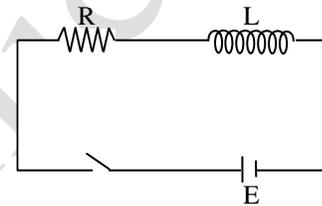
- (A) $\frac{e^2}{e^4 - 1}$ (B) $\left(\frac{e^2}{e^2 + 1}\right)^2$
- (C) $\frac{e^2 - 1}{e^4 + 1}$ (D) None of these

Q.70 Calculate the ratio of current flowing through the battery at $t = 0$ and $t = \infty$. ($t = 0$ is the time of closing of switch)-



- (A) 1 (B) 2 (C) $\frac{1}{2}$ (D) 0

Q.71 Plot the variation of emf across the inductor with respect time-



- (A)
- (B)
- (C)
- (D)

Questions based on

Transformer & AC generator

Q.72 To transmit electrical energy from a generator to distant consumers-
 (A) high voltage and low current are transmitted
 (B) high voltage and high current are transmitted
 (C) low voltage and low current are transmitted
 (D) low voltage and high current are transmitted

Q.73 A transformer transforms 220 volts to 11 volts. If the current strength in the primary

coil is 5 amp. and that in the secondary, 90 amp, what is the efficiency of the transformer-

- (A) 90 %
- (B) 100 %
- (C) 211 %
- (D) 150 %

Q.74 A step up transformer operates on a 230 volt line and supplies a load of 2 amp. The ratio of primary and secondary windings is 1 : 25. Determine the primary current-

- (A) 12.5 amp
- (B) 50 amp
- (C) 8.8 amp
- (D) 25 amp

Q.75 A transformer is used to light 140 watt 24 volt lamp from 240 volt AC mains, the current in the main cable is 0.7 amp. The efficiency of the transformer is-

- (A) 63.8%
- (B) 84%
- (C) 83.3%
- (D) 48%

Q.76 In a step-up transformer, in comparison with the secondary the primary coil has-

- (A) less voltage and high current
- (B) high voltage and less current
- (C) less voltage and less current
- (D) high voltage and high current

Q.77 In the secondary coil of step-up transformer, the number of turns are-

- (A) more and the copper wire is thicker
- (B) more and the copper wire is thinner
- (C) less and the copper wire is thicker
- (D) less and the copper wire is thinner

Q.78 A dynamo-

- (A) creates electrical energy
- (B) converts mechanical energy into electrical energy
- (C) converts electrical energy into mechanical energy
- (D) creates mechanical energy

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