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) oersted

PEI001

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

PEI002

FARADAY LAW & LENZ'S LAW

3. According to Faraday's Laws of electromagnetic induction:
(1) The direction of the induced current is such that it opposes itself
(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 itself
(4) None of the above

PEI003

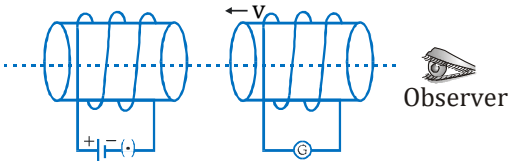
4. A coil having an area of 2m² is placed in a magnetic field which changes from 1 Weber/m² to 4 Weber/m² in 2 seconds. The e.m.f. induced in the coil will be :–
(1) 4 volt (2) 3 volt (3) 2 volt (4) 1 volt

PEI004

5. Magnetic field through a coil is changed with respect to time and an emf is induced in it. Select the incorrect statement 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

PEI005

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

PEI006

7. A coil of resistance 10Ω and 1000 turns have the magnetic flux line of 5.5×10^{-4} Wb. If the magnetic flux changed to 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

PEI007

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

PEI008

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

PEI009

10. 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

PEI010

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) 1.6×10^{-3} C (2) 16×10^{-3} C
(3) 0.16×10^{-3} C (4) 160×10^{-3} C

PEI011

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

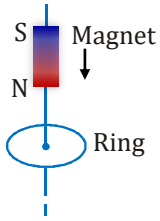
PEI012

13. An emf is induced in a coil. The linking magnetic flux

(1) Must be decreasing
(2) Must be increasing
(3) Must remain constant
(4) Can be either increasing or decreasing

PEI013

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 acceleration of the falling magnet is (g is acceleration due to gravity) :-



(1) More than g
(2) Equal to g
(3) Less than g
(4) Depend on mass of magnet

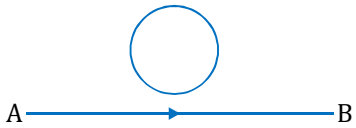
PEI014

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

PEI015

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

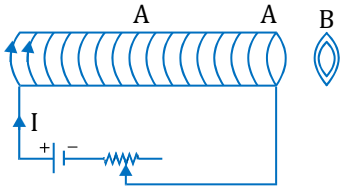
PEI016

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

PEI017

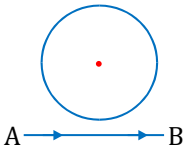
18. An aluminium ring B faces an electromagnet A. The current I through A can be altered. Then which of the following statement is correct :-



(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

PEI018

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

PEI019

20. 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) $Q = \frac{1}{R} \cdot \frac{\Delta\phi}{\Delta t}$

PEI020

21. If number of turns of $70cm^2$ coil is 200 and it is placed in a magnetic field of $0{\cdot}8\ Wb/m^2$ 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

PEI021

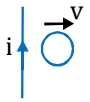
22. A circular loop of radius r is placed in a region where magnetic field increases with respect to time as B(t) = at then induced emf in coil :-

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

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

PEI022

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

PEI023

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

PEI024

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

PEI025

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

PEI026

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

PEI027

28. If a current of 2A give rise a magnetic flux of 5×10^{-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) 5×10^{-7} joule

(3) 5×10^{-3} joule (4) 0.5 joule

PEI028

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%

PEI029

30. A constant current I is 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

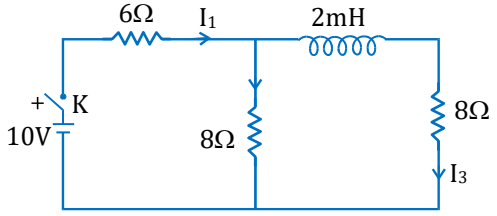
PEI030

31. The inductance of a solenoid is 5H 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
PEI031

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
PEI032

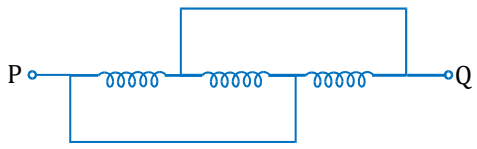
33. During 0.1s current in a coil increases from 1A to 1.5A. If inductance of this coil is 60 μH, induced current in external resistance of 600 μΩ is :-
(1) 1A (2) 4/3 A
(3) 2/3 A (4) 1/2 A
PEI033

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
PEI034

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



(1) 1H (2) 2H (3) 3H (4) 9H
PEI035

36. The time constant of an inductance coil is 2.0×10^{-3} s. When a 90 Ω resistance is joined in series, the time constant becomes 0.5×10^{-3} s. The inductance and resistance of the coil are :-
(1) 30mH ; 30Ω (2) 30mH ; 60Ω
(3) 60mH ; 30Ω (4) 60mH ; 60Ω
PEI036

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) $I^2\phi$
PEI037

38. The self-inductance of a toroid is
(N: no. of turns, r: radius of cross section, R_m: mean radius of toroid) :-
(1) $\frac{\mu_0 N^2 r^2}{2R_m}$ (2) $\frac{\mu_0 N^2 \pi r}{2R_m}$
(3) $\frac{\mu_0 N^2 r}{2R_m}$ (4) $\frac{\mu_0 N^2 r\pi}{R_m}$
PEI038

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
PEI039

40. Energy is stored in the choke coil in the form of:-
(1) Heat
(2) Electric field
(3) Magnetic field
(4) Electro-magnetic field
PEI040

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
PEI041

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 A/min. The inductance of the coil is :–
(1) 0.5 henry (2) 15 henry
(3) 1.5 henry (4) 9.6 henry
PEI042

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
PEI043

44. A coil of resistance 10Ω and an inductance 5H is connected to a 100V battery. Then energy stored in the coil is :-
(1) 125 erg (2) 125 J
(3) 250 erg (4) 250 J
PEI044

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
PEI045

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
PEI046

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
PEI047

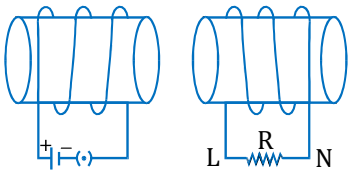
48. When current in a coil is reduced from 2A to 1A in 1ms, the induced emf is 5V. The inductance of coil is :
(1) 5 H (2) 5000 H
(3) 5 mH (4) 50 H
PEI048

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
PEI049

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)
PEI050

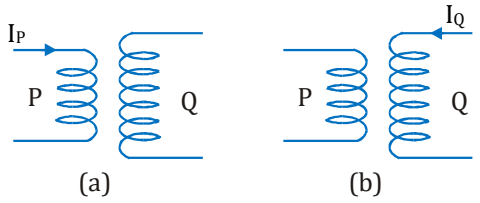
MUTUAL INDUCTION, TRANSFORMER AND EDDY CURRENTS

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
PEI051

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 $5As^{-1}$, an emf of 2 mV is induced in Q. The current in P is then switched off, and a current changing at $2A\ s^{-1}$ is fed through Q as shown in diagram. What emf will be induced in P:-



(1) 8×10^{-4} V (2) 2×10^{-8} V
(3) 5×10^{-3} V (4) 8×10^{-2} V

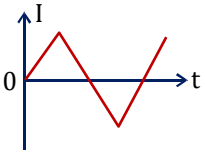
PEI052

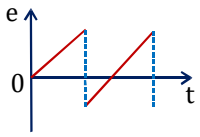
53. A small square loop of wire of side ℓ is placed inside a large square loop of wire of side L(L >> ℓ). The loops are coplanar and their centres coincide. The mutual inductance of the system is proportional to:-

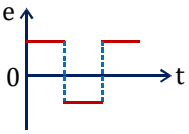
(1) $\frac{\ell}{L}$ (2) $\frac{\ell^2}{L}$
(3) $\frac{L}{\ell}$ (4) $\frac{L^2}{\ell}$

PEI053

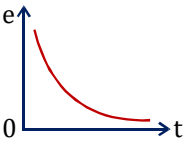
54. A current time curve is shown in the following diagram. This type of current is passed in the primary coil of transformer. The nature of induced emf in the secondary coil will be :-



(1) 

(2) 

(3) 

(4) 

PEI054

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/s. The maximum value of induced emf in second coil is

(1) 4π V (2) 3π V
(3) 2π V (4) π V

PEI055

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

PEI056

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)

PEI057

58. Which type of losses does not occur in transformer:-
(1) mechanical losses
(2) copper losses
(3) hysteresis losses
(4) eddy current losses

PEI058

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

PEI059

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

PEI060

61. The 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

PEI061

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

PEI062

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) $\frac{3P}{2}$

PEI063

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

PEI064

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

PEI065

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 × 20 volt

(3) $\frac{2500}{80\times20}$ volt (4) $\frac{2500\times20}{80}$ volt

PEI066

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

PEI067

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

PEI068

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 :-

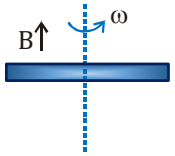
(1) $2.4\pi \times 10^{-5}$ H (2) $4.8\pi \times 10^{-4}$ H

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

PEI069

DYNAMIC & ROTATIONAL E.M.F. GENERATOR

70. A conducting rod of length 2ℓ is rotating with constant angular speed ω 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

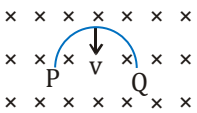
PEI070

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

PEI071

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

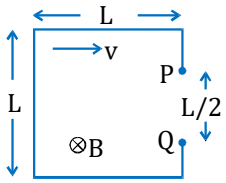
(2) 2 BRv, end P at high potential

(3) 2 BRv, end Q at high potential

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

PEI072

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

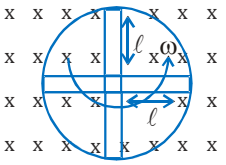
(2) $e = \frac{BLv}{2}$, P is positive with respect to Q

(3) e = 0

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

PEI073

74. A conducting wheel in which there are four rods of length ℓ 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 :

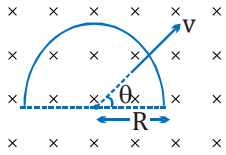


(1) $2B\omega\ell^2$ (2) $\sqrt{B\ell^2\omega}$

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

PEI074

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 :

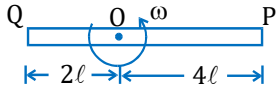


(1) Bv (πR) cosθ (2) Bv(pR) sinθ

(3) Bv(2R) cosθ (4) Bv(2R) sinθ

PEI075

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 :

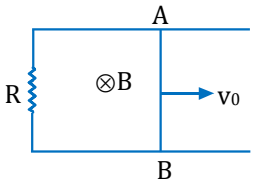


(1) $6B\omega\ell^2$ (2) $B\omega\ell^2$

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

PEI076

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) $v = -v_0$

PEI077

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.

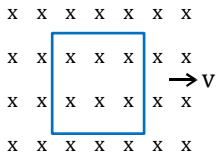
(2) lines of flux will be maximum, but the induced emf will be zero.

(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.

PEI078

79. A conducting square loop of side ℓ 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

PEI079

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

PEI080

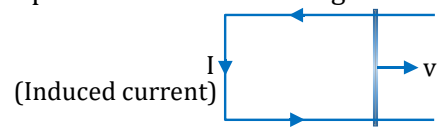
81. Dynamo which produces electricity, is a source of:

(1) gravity (2) magnetism

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

PEI081

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

PEI082

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) ωBR^2

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

PEI083

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

PEI084

85. Dynamo is based on the principle of :-

(1) electro magnetic induction

(2) induced current

(3) induced magnetism

(4) Faraday effect

PEI085

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

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

(3) π (4) 2π

PEI086

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) $NAB\omega$ (2) $NABR\omega$

(3) NAB (4) NABR

PEI087

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

PEI088

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:-

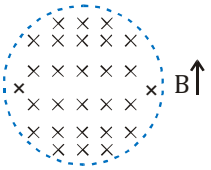
(1) $B(ab)\omega\cos\omega t$ (2) $B(ab)\omega\sin\omega t$

(3) $-B(ab)\omega\sin\omega t$ (4) $-B(ab)\omega\cos\omega t$

PEI089

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

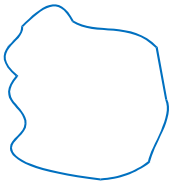
PEI090

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) 4×10^{-3} N (2) 8×10^{-3} N
(3) 6×10^{-2} N (4) 8×10^{-2} N

PEI091

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

PEI092

EXERCISE-I (Conceptual Questions) ANSWER KEY

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

Exercise - II (Previous Year Questions) AIPMT/NEET

AIPMT 2014

1. 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 :-

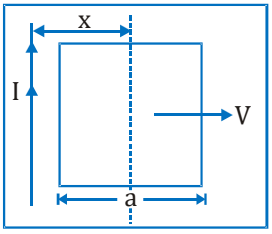
(1) 300 V, 15A (2) 450 V, 15A

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

PEI105

AIPMT 2015

2. 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:



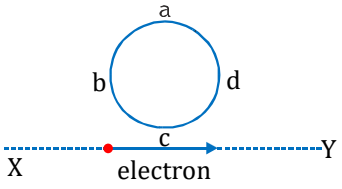
(1) $\frac{1}{(2x-a)^2}$ (2) $\frac{1}{(2x+a)^2}$

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

PEI106

Re-AIPMT 2015

3. 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

PEI107

NEET-I 2016

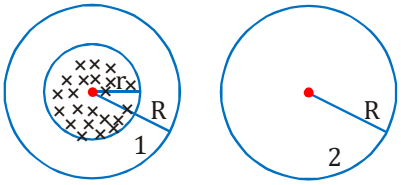
4. A long solenoid has 1000 turns. When a current of 4A flows through it, the magnetic flux linked with each turn of the solenoid is 4×10^{-3} Wb. The self inductance of the solenoid is :-

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

PEI108

NEET-II 2016

5. 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

PEI109

NEET(UG) 2017

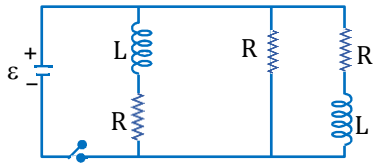
6. A long solenoid of diameter 0.1 m has 2×10^4 turns per meter. At the centre of the solenoid, a coil of 100 turns and radius 0.01 m is placed with its axis coinciding with the solenoid axis. The current in the solenoid reduces at a constant rate to 0A from 4 A in 0.05 s. If the resistance of the coil 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

PEI110

7. 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

PEI111

NEET(UG) 2018

8. 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

PEI112

NEET(UG) 2019

9. A 800 turn coil of effective area 0.05 m^2 is kept perpendicular to a magnetic field 5×10^{-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) 2×10^{-3} V (4) 0.02 V

PEI113

10. 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

PEI114

NEET(UG) 2019 (Odisha)

11. 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

PEI115

NEET(UG) 2020 (Covid-19)

12. 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

PEI116

13. 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) 2.51×10^{-4} V
(2) 2.51×10^{-5} V
(3) 4.0×10^{-5} V
(4) 2.51 V

PEI117

NEET(UG) 2021

14. 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

PEI118

15. 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) $\frac{R_2^2}{R_1}$

PEI119

NEET(UG) 2022

16. A big circular coil of 1000 turns and average radius 10 m is rotating about its horizontal diameter at 2 rad s^{-1}. If the vertical component of earth's magnetic field at that place is 2×10^{-5} T and electrical resistance of the coil is 12.56 Ω, then the maximum induced current in the coil will be :

(1) 1.5 A (2) 1 A
(3) 2 A (4) 0.25 A

PEI120

RE-NEET(UG) 2022

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

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

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

(1) 108 V (2) 197 V
(3) 150 V (4) 192 V

PEI121

NEET(UG) 2023

18. A 12 V, 60 W lamp is connected to the secondary of a step down transformer, whose primary is connected to ac mains of 220 V. Assuming the transformer to be ideal, what is the current in the primary winding?

(1) 2.7 A (2) 3.7 A
(3) 0.37 A (4) 0.27 A

PEI136

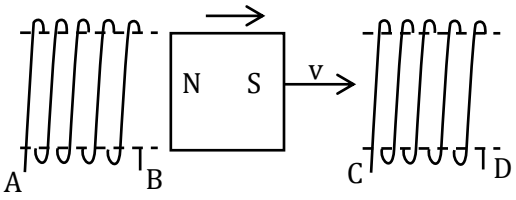
19. The magnetic energy stored in an inductor of inductance 4 μH carrying a current of 2 A is :

(1) 4 mJ (2) 8 mJ
(3) 8 μJ (4) 4 μJ

PEI137

NEET(UG) 2024

20.



Solenoid-1 Solenoid-2

In the above diagrams, a strong bar magnet is moving towards solenoid-2 from solenoid-1. The direction of induced current in solenoid-1 and that in solenoid-2, respectively, are through the directions :

(1) AB and DC (2) BA and CD
(3) AB and CD (4) BA and DC

PEI138

21. In a ideal transformer, the turns ratio $\frac{N_p}{N_s} = \frac{1}{2}$.

The ratio $V_s : V_p$ is equal to (the symbols carry their usual meaning) :

(1) 1 : 2 (2) 2 : 1
(3) 1 : 1 (4) 1 : 4

PEI139

RE-NEET(UG) 2024

22. Let us consider two solenoids A and B, made from same magnetic material of relative permeability μ_r and equal area of cross-section. Length of A is twice that of B and the number of turns per unit length in A is half that of B. The ratio of self inductance of the two solenoids, $L_A : L_B$ is :

(1) 1 : 2 (2) 2 : 1 (3) 8 : 1 (4) 1 : 8

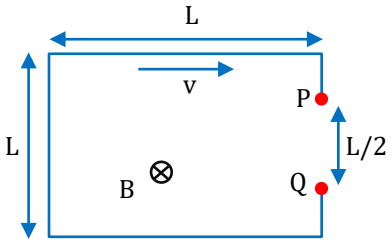
PEI140

EXERCISE-II (Previous Year Questions) ANSWER KEY

Question	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Answer	2	3	4	4	2	2	2	4	4	4	2	2	1	1	4
Question	16	17	18	19	20	21	22								
Answer	2	4	4	3	1	2	1								

Exercise – III (Analytical Questions) Master Your Understanding

1. The loop shown moves with a velocity v in a uniform magnetic field of magnitude B, directed into the paper as shown in the figure. The potential difference between points P and Q is e. Then



(a) $e = \frac{1}{2}BL\nu$

(b) $e = BL\nu$

(c) P is positive with respect to Q

(d) Q is positive with respect to P

(1) only a is correct

(2) only a & c are correct

(3) only b is correct

(4) only b & d are correct

PEI122

2. Choose the correct options

(a) SI unit of magnetic flux is henry-ampere

(b) SI unit of coefficient of self-induction is J/A

(c) SI unit of coefficient of self-induction is $\frac{\text{volt}-\text{second}}{\text{ampere}}$

(d) SI unit of magnetic induction is weber

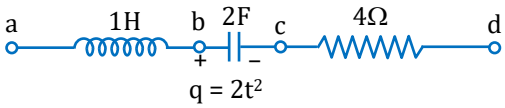
(1) only (a) (2) only (b)

(3) (a) and (c) (4) (b) and (d)

PEI123

3. In the figure shown, q is in coulomb and t in second.

At time t = 1s



(a) $V_a - V_b = 4V$

(b) $V_b - V_c = 1V$

(c) $V_c - V_d = 16V$

(d) $V_a - V_d = 20V$

(1) only (a) is correct

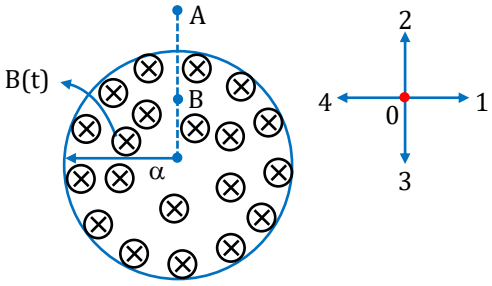
(2) only (b) is correct

(3) (a), (b) and (c) are correct

(4) only (d) is correct

PEI124

4. A uniform but time varying magnetic field B(t) exists in a cylindrical region of radius α and is directed into the plane of the paper, as shown in fig. The magnetic field decreases at a constant rate inside the region. If r is the distance from the axis of the cylindrical region then match column I to column II.



	Column-I		Column-II
I.	Induced electric field at point A	a.	0 to 1
II.	Induced electric field at point B	b.	Zero
III.	Force on an electron placed at point A	c.	0 to 4
IV.	Force on an electron placed at point B	d.	0 to 2

(1) I – a, II – d, III – d, IV – a

(2) I – d, II – a, III – c, IV – a

(3) I – a, II – b, III – c, IV – d

(4) I – a, II – a, III – c, IV – c

PEI125

5. Match the column.

	Column-I		Column-II
(a)	Magnetic field	(p)	$[M^1T^{-2}A^{-1}]$
(b)	Coefficient of self induction	(q)	$[T^2]$
(c)	LC	(r)	$[ML^2T^{-2}A^{-2}]$
(d)	Magnetic flux	(s)	None of these

(1) a – p, b – r, c – q, d – s

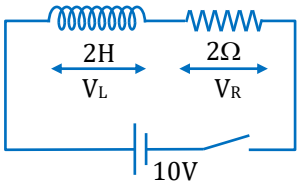
(2) a – p, b – q, c – r, d – s

(3) a – p, b – s, c – q, d – r

(4) a – s, b – s, c – s, d – r

PEI126

6. In the circuit shown in figure, switch is closed at time t = 0. Match the following two columns.

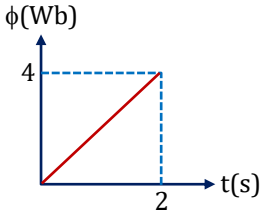


	Column-I		Column-II
(a)	V_L at t = 0	(p)	zero
(b)	V_R at t = 0	(q)	10V
(c)	V_L at t = 1s	(r)	$\frac{10}{e}$V
(d)	V_R at t = 1s	(s)	$\left(1-\frac{1}{e}\right)$10V

(1) a – q, b – p, c – r, d – s
(2) a – q, b – r, c – p, d – s
(3) a – r, b – q, c – r, d – s
(4) a – s, b – r, c – p, d – q

PEI127

7. Magnetic flux passing through a coil of resistance 2Ω is as shown in figure. Match the following two columns. In column II all physical quantities are in SI units.



	Column-I		Column-II
(a)	Induced emf produced	(p)	4
(b)	Induced current	(q)	1
(c)	Charge flow in 2s	(r)	8
(d)	Heat generation in 2s	(s)	2

(1) a-s, b-q, c-s, d-p (2) a-q, b-r, c-p, d-s
(3) a-p, b-q, c-r, d-s (4) a-r, b-q, c-s, d-p

PEI128

8. Given below are two statements: one is labelled as **Assertion (A)** and the other is labelled as **Reason (R)**.
Assertion (A) : Transformer can't be used to step up or step down the steady dc voltage
Reason (R) : Transformers are based upon the principle of mutual induction for which a time varying voltage is necessary.
In the light of the above statements, choose the most appropriate answer from the options given below:
(1) Both **(A)** and **(R)** are true and **(R)** is the correct explanation of **(A)**.
(2) Both **(A)** and **(R)** are true and **(R)** is NOT the correct explanation of **(A)**.
(3) **(A)** is true but **(R)** is false.
(4) **(A)** is false but **(R)** is true.

PEI129

9. Given below are two statements: one is labelled as **Assertion (A)** and the other is labelled as **Reason (R)**.
Assertion (A) : The direction of induced current is always such as to oppose the change that causes it.
Reason (R) : The direction of induced current is given by Lenz's law.
In the light of the above statements, choose the most appropriate answer from the options given below:
(1) Both **(A)** and **(R)** are true and **(R)** is the correct explanation of **(A)**.
(2) Both **(A)** and **(R)** are true and **(R)** is NOT the correct explanation of **(A)**.
(3) **(A)** is true but **(R)** is false.
(4) **(A)** is false but **(R)** is true.

PEI130

10. Given below are two statements: one is labelled as **Assertion (A)** and the other is labelled as **Reason (R)**.
Assertion (A) : A time varying magnetic field induces an electric field.
Reason (R) :- An inductor always tends to keep the flux constant.
In the light of the above statements, choose the most appropriate answer from the options given below:
(1) Both **(A)** and **(R)** are true and **(R)** is the correct explanation of **(A)**.
(2) Both **(A)** and **(R)** are true and **(R)** is NOT the correct explanation of **(A)**.
(3) **(A)** is true but **(R)** is false.
(4) **(A)** is false but **(R)** is true.

PEI131

11. Given below are two statements: one is labelled as **Assertion (A)** and the other is labelled as **Reason (R)**.

Assertion (A) : The mutual inductance of coil 1 with respect to coil 2 is the same as mutual inductance of coil 2 with respect to coil 1.

Reason (R) : Mutual inductance between coils is independent of current passing through the coil

In the light of the above statements, choose the most appropriate answer from the options given below:

(1) Both **(A)** and **(R)** are true and **(R)** is the correct explanation of **(A)**.

(2) Both **(A)** and **(R)** are true and **(R)** is NOT the correct explanation of **(A)**.

(3) **(A)** is true but **(R)** is false.

(4) **(A)** is false but **(R)** is true.

PEI132

12. Given below are two statements: one is labelled as **Assertion (A)** and the other is labelled as **Reason (R)**.

Assertion (A) : The electric field created by time-varying magnetic field is non-conservative.

Reason (R) : The line integral of induced electric field in a closed loop is always equal to zero.

In the light of the above statements, choose the most appropriate answer from the options given below:

(1) Both **(A)** and **(R)** are true and **(R)** is the correct explanation of **(A)**.

(2) Both **(A)** and **(R)** are true and **(R)** is NOT the correct explanation of **(A)**.

(3) **(A)** is true but **(R)** is false.

(4) **(A)** is false but **(R)** is true.

PEI133

13. Given below are two statements: one is labelled as **Assertion (A)** and the other is labelled as **Reason (R)**.

Assertion (A) : Magnetic flux is a scalar quantity.

Reason (R) : Value of magnetic flux cannot be negative.

In the light of the above statements, choose the most appropriate answer from the options given below:

(1) Both **(A)** and **(R)** are true and **(R)** is the correct explanation of **(A)**.

(2) Both **(A)** and **(R)** are true and **(R)** is NOT the correct explanation of **(A)**.

(3) **(A)** is true but **(R)** is false.

(4) **(A)** is false but **(R)** is true.

PEI134

14. Given below are two statements: one is labelled as **Assertion (A)** and the other is labelled as **Reason (R)**.

Assertion (A) : When a coil is rotated in a uniform magnetic field about an diametrical axis perpendicular to the field, emf is induced in it which is maximum for the orientation of coil in which magnetic flux through the coil is zero.

Reason (R) : In an electric generator, electrical energy is generated by rotating a coil in a magnetic field.

In the light of the above statements, choose the most appropriate answer from the options given below:

(1) Both **(A)** and **(R)** are true and **(R)** is the correct explanation of **(A)**.

(2) Both **(A)** and **(R)** are true and **(R)** is NOT the correct explanation of **(A)**.

(3) **(A)** is true but **(R)** is false.

(4) **(A)** is false but **(R)** is true.

PEI135

EXERCISE-III (Analytical Questions) ANSWER KEY

Question	1	2	3	4	5	6	7	8	9	10	11	12	13	14	
Answer	2	3	3	4	1	1	1	1	1	2	2	3	3	2	