SRIGAYATRI EDUCATIONAL INSTITUTIONS

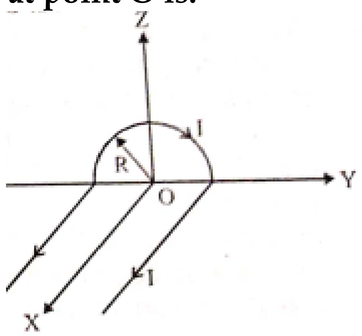
INDIA

CURRENT ELECTRICITY-UT3

1. **Two long parallel wires carry currents i_1 and i_2 such that $i_1 > i_2$. When the current are in the same direction, the magnetic. Field at a point midway between the wires is** 6×10^{-6} T. if the direction of i_2 is reversed the field **becomes** 3×10^{-5} T . the ratio of $\frac{i_1}{i_2}$

a) $\frac{1}{2}$ b) 2 c) $\frac{2}{3}$ d) $\frac{3}{2}$

2. **A wire carrying current I has the shape as shown in adjoining figure. Linear parts of the wire are very long and parallel to X-axis while semicircular portion of radius R is lying in Y-Z plane, Magnetic filed at point O is:**



(a) $\vec{B} = -\frac{\mu_0}{4\pi}\frac{I}{R}\left(\mu\hat{i}\times 2k\right)$ (b) $\vec{B} = -\frac{\mu_0}{4\pi}\frac{I}{R}\left(\pi\hat{i}+2k\right)$

(c) $\vec{B} = -\frac{\mu_0}{4\pi}\frac{I}{R}\left(\pi\hat{i}-2k\right)$ (d) $\vec{B} = \frac{\mu_0}{4\pi}\frac{I}{R}\left(\pi\hat{i}+2k\right)$

3. **A closely wound solenoid of 2000 turns and area of cross section 1.5 × 10^{-4} m^2carries a current of 2.0 A. It suspended through its centre and perpendicular to its length, allowing it to turn in a horizontal plane in a uniform magnetic field 5 ×10^{-2} tesla making an angle of 30^0 with the axis of the solenoid. The torque on the solenoid will be:**

(a) $3\times10^{-2} N-m$ (b) $3\times10^{-3} N-m$ (c) $1.5\times10^{-3} N-m$ (d) $1.5\times10^{-2} N-m$

4. **An alternating electric field, of frequency y, is applied across the dccs (radius -R) of a cyclotron that is being used to acetate protons (mass =m) The operating magnetic field (B) used in the cyclotron and the kinetic energy (K) of the proton beam, produced by it, are given by:**

a) $B = \frac{mv}{e}$ and $K = 2m\pi^2v^2R^2$ b) $B = \frac{2\pi mv}{e}$ and $K = m^2\pi vR^2$

c) $B = \frac{2\pi mv}{e}$ and $K = 2m\pi^2v^2R^2$ d) $B = \frac{mv}{e}$ and $K = m^2\pi vR^2$

5. **A galvanometer of 50 ohm resistance has 25 divisions. A current of 4 ×10^{-4} ampere gives a deflection of one per division. To convert this galvanometer into a voltmeter having a range of 25 volts, it should be connected with a resistance of**

(a) 2450 Ω in series (b) 2500 Ω in series.(c) 245 Ω in series.(d) 2550 Ω in series.

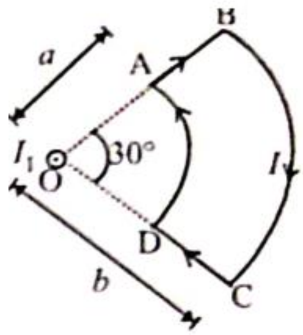
6. **In the adjoining figure, two very long, parallel wires A and B carry currents of 10 ampere and 20 ampere respectively, and are at a distance 20 cm apart. If a third wire C (length 15cm) having a current of 10 ampere is placed between them, then how much force will act on C ? The direction of current in all the three wires is same.**

(a) 3×10^{-5}N (left) (6) 3×10^{-5}N (right) (c) 6×10^{-5}N (left) (d) $6 \times 10+$N (right)

7. **A 2 μC charge moving around a circle with a frequency of 6.25×10^{12}Hz produces a magnetic field 6.28 tesla at the centre of the circle. The radius of the circle is**

(a) 2.25 m (b) 0.25 m (c) 13.0 m (c) 1.25 m

8. **A current loop ABCD is held fixed on the plane of the paper as shown in the figure. The arcs BC (radius =b) and DA (radius =a) of the loop are joined by two straight wires A B and CD. A steady current I is flowing in the loop. Angle made by AB and CD at the origin O is 30^0 Another straight thin wire with steady current I_1 flowing out of the plane of the paper is kept at the origin. The magnitude of the magnetic field (B) due to the loop ABCD at the origin (O) is:**



a) $\frac{\mu_0 I(b-a)}{24ab}$ b) $\frac{\mu_0 I}{4\pi}\left[\frac{b-a}{ab}\right]$ c) $\frac{m_0 I}{4p}\left[2(b-a)+p/3(a+b)\right]$ d) zero

9. **A galvanometer of resistance, G is shunted by a resistance S ohm. To keep the main current in the circuit unchanged. the resistance to be put in series with the galvanometer is**

a) $\frac{S^2}{(S+G)}$ b) $\frac{SG}{(S+G)}$ c) $\frac{G^2}{(S+G)}$ d) $\frac{G}{(S+G)}$

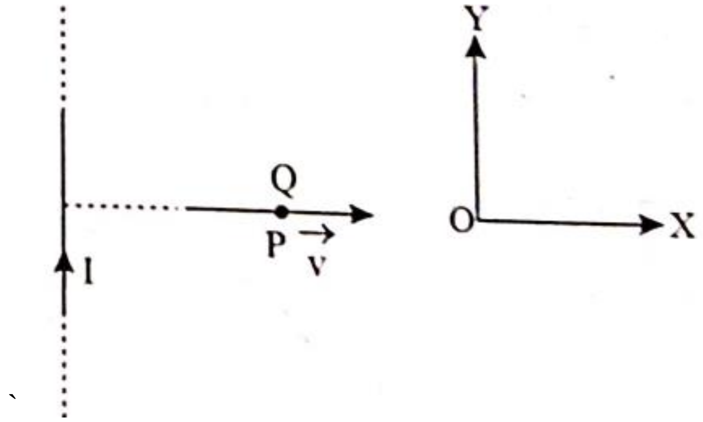
10. **A beam of electrons is moving with constant velocity in a region having simultaneous perpendicular electric and magnetic fields of strength 20 Vm^{-1} and 0.5 T respectively at right angles to the direction of motion of the electrons. Then the velocity of electrons must be**

a) 8m/s b) 20m.e c) 40 m/s d) 1/40 m/s

11. **A current *I* flows in an infinitely long wire with cross section in the form of a semi-circular ring of radius R. The magnitude of the magnetic induction along its axis is:**

(a) $\frac{\mu_0 I}{2\pi^2 R}$ (b) $\frac{\mu_0 I}{2\pi R}$ (c) $\frac{\mu_0 I}{4\pi R}$ (d) $\frac{\mu_0 I}{\pi^2 R}$

12. **A very long straight wire carries a current I. At the instant when a charge +Q at point P has velocity $\vec{v}$, as shown. the force on the charge is**

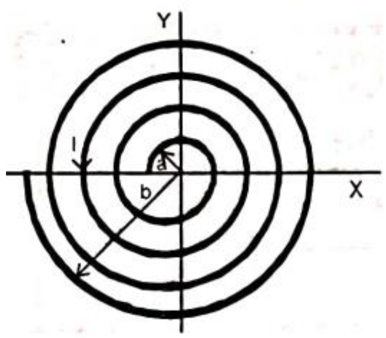


(a) along OY (b) opposite to OY (c) along OX (d) opposite to OX

13. A particle of mass m and charge q, accelerated by potential field B. If d is the thickness of region of magnetic field, then deviation of the particle from initial direction when is leaves the field is

a) $\sin^{-1}\left[Bd\left(\frac{q}{2mV}\right)^{1/2}\right]$ b) $\cos^{-1}\left[Bd\left(\frac{q}{2mV}\right)^{1/2}\right]$ c) $\tan^{-1}\left[Bd\left(\frac{q}{2mV}\right)^{1/2}\right]$ d) zero

14. A long insulated copper wire is closely wound as a spiral of "N" turns. The spiral has inner radius ' a ' and outer radius "b '. The spiral lies in the XY plane and a steady current ' I' flows through the wire. The Z -component of the magnetic field at the centre of the spiral is

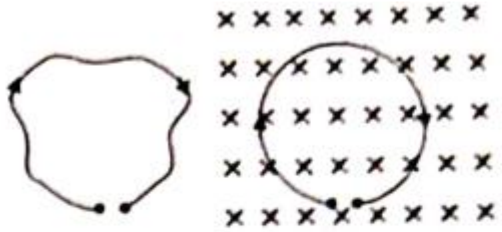


a) $\frac{\mu_0 NI}{2(b-a)}\ln\left(\frac{b}{a}\right)$ b) $\frac{\mu_0 NI}{2(b-a)}\ln\left(\frac{b+a}{b-a}\right)$ c) $\frac{\mu_0 NI}{2b}\ln\left(\frac{b}{a}\right)$ d) $\frac{\mu_0 NI}{2b}\ln\left(\frac{b+a}{b-a}\right)$

15. A particle of charge q and mass m moves in a circular orbit of radius r with angular speed ω. The ratio of the magnitude of its magnetic moment to that of its angular momentum depends on

(a) ω and q (b) ω, q and m (c) q and m (d) ω and m

16. **A thin flexible wire of length L is connected to two adjacent fixed points and carries a current I in the clockwise direction, as shown in the figure. When the system is put in a uniform magnetic field of strength B going into the plane of the paper, the wire takes the shape of a circle. The tension in the wire is**



a) IBL b) $\frac{IBL}{\pi}$ c) $\frac{IBL}{2\pi}$ d) $\frac{IBL}{4\pi}$

17. In a mass spectrometer used for measuring the masses of ions. the ions are initially accelerated by an electric potential V and then made to describe semicircular path of

radius R using a magnetic field B. If V and B are kept constant, the ratio $\left(\frac{\text{charge on the ion}}{\text{mass of the ion}}\right)$ will be proportional to

(a) $1/R^2$ (b) R^2 (c) R (d) 1 / R

18. **A cyclotron's oscillator frequency is 10 MHz. If the radius of its 'dees' is 60 cm, what is the kinetic energy of the proton beam produced by the accelerator?**
Given $e=1.60 \times 10^{-19}$C, $m=1.67 \times 10^{-27}$kg.
1 MeV=1.6×10^{-13}J

(a) 3.421 MeV (b) 4.421 MeV (c) 5.421 MeV (d) 7.421 MeV

19. **The deflection in a galvanometer falls from 50 division to 20 when a 12 ohm shunt is applied. The galvanometer resistance is**

(a) 18 ohm (b) 36 ohm (c) 24 ohm (d) 30 ohm

20. **When a long wire carrying a steady current is bent into a circular coil of one turn, the magnetic induction at its centre is . When the samè wire carrying the same current is bent to form a circular coil of n turns of a smaller radius, the magnetic induction at the centre will be**

(a) B / n (b) nB (c) B / n^2 (d) n^2B

PART-II (NUMERICAL/INTEGER TYPE QUESTIONS)

21. **A 10 eV electron is circulating in a plane at right angles to a uniform field at magnetic induction 10^{-4}Wb / m^2=1.0 gauss). The orbital radius (in cm) of the electron is**

22. **An insulating rod of length *l* carries a charge q distributed uniformly on it. The rod is pivoted at its mid point and is rotated at a frequency f about a fixed axis perpendicular to rod and passing through the pivot. The magnetic moment of the rod system is $\frac{1}{2a}\pi q f l^2$ .Find the value of a.**

23. **A moving coil galvanometer has 150 equal divisions. Its current sensitivity is 10 - divisions per milliampere and voltage sensitivity is 2 divisions per millivolt. In order that each division reads 1 volt, the resistance in ohms needed to be connected in series with the coil will be**

24. **A long straight wire of radius a carries a steady current i. The current is uniformly distributed across its cross section. The ratio of the magnetic field at a / 2 and 2a is**

25. **A uniformly charged ring of radius 10 cm rotates at a frequency of 10^4 rps about its axis. The ratio of energy density of electric field to the energy density of the magnetic field at a point on the axis at distance 20cm from the centre is 9.1×10^a. Find the value of a.**

KEY SHEET

1) **D**	2) **B**	3) **D**	4) **C**	5) **A**	6) **B**	7) **D**	8) **A**	9) **C**	10) **C**
11) **D**	12) **A**	13) **A**	14) **A**	15) **C**	16) **C**	17) **A**	18) **D**	19) **A**	20) **D**
21) **11**	22) **6**	23) **9995**	24) **1**	25) **9**					

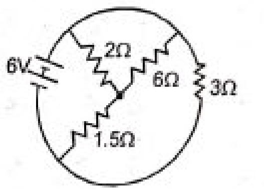
CURRENT ELECTRICITY-1

1. **Two sources of equal emf are connected to an external resistance R. The internal resistance of the two sources are R_1 and R_2 $(R_1>R_2)$. If the potential difference across the source having internal resistance R_2 is zero, then**

a) $R=R_2-R_1$ b) $R=R_2\times(R_1+R_2)/(R_2-R_1)$

c) $R=R_1R_2/(R_2-R_1)$ d) $R=R_1R_2/(R_1-R_2)$

2. **The total current supplied to the circuit by the battery is**

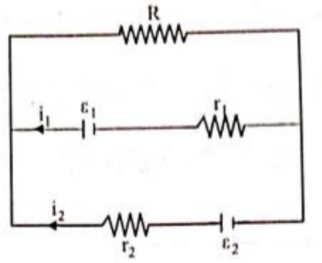


(a)4A (b) 2A (c)1A (d)6A

3. **To get maximum current in a resistance of 3 ohms, one can use n rows of m, cells (connected in series) connected in parallel. If the total number of cells is 24 and the internal resistance of a cell is 0.5 ohms then**

(a) m =12,n=2 (b) m=8,n=3 (c) m=2,n=12 (d) m=6,n=4

4. **See the electric circuit shown in the figure. Which of the following equations is a correct equation for it**



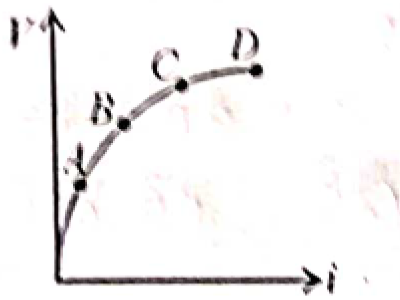
a) $\varepsilon_2-i_2r_2-\varepsilon_1-i_1r_1=0$ b) $-\varepsilon_2-(i_1+i_2)R+i_2r_2=0$

c) $\varepsilon_1-(i_1+i_2)R+i_1r_1=0$ d) $\varepsilon_1-(i_1+i_2)R-i_1r_1=0$

5. **In a neon gas discharge tube Ne^+ ions moving through a cross-section of the tube each second to the right is 2.9×10^{18}, while 1.2×10^{18} electrons move towards left in the same time; the electronic charge being 1.6×10^{-19}C, the net electric current is**

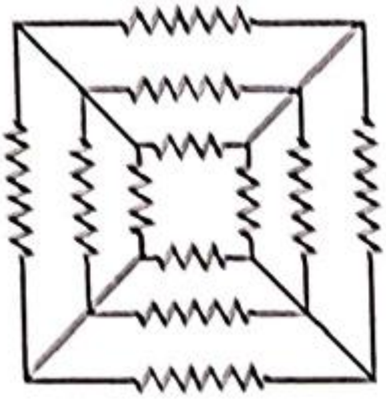
a) 0.27 A to the right b) 0.66 A to the right c) 0.66 A to the left d) zero

6. **Variation of current pissing through a conductor as the adjoining diagram. If the resistance (R) is determined at the points A, B, C and D, m.e will find that**



a) $R_C=R_D$ b) $R_B>R_A$ c) $R_C>R_B$ d) $R_A>R_B$

7. **Twelve resistors each of resistance 16 Ω are connected in**

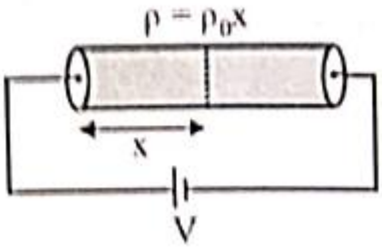


a) 1 Ω b) 2 Ω c) 3Ω d) 3Ω

8. **The masses of the three wires of copper are in the ratio of 1:3:5 and their lengths are in the ratio of 5:3:1. The of their electrical resistance is**

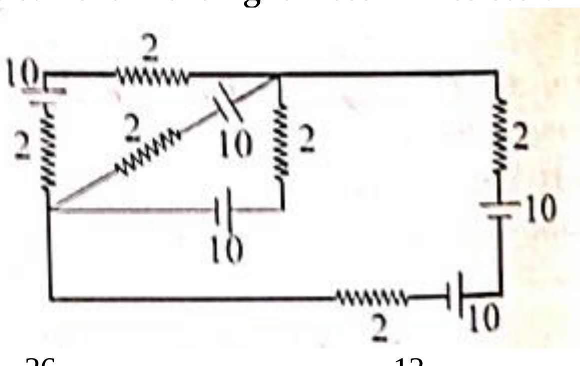
a) **1:3:5** b) **5:3:1** c) **1:25:125** d) 125:25:1

9. **A cylinder solid of length l, and radius a is having varying resistivity given by P=P$_0$X, where P$_0$ is a positive constant and x is measured from left end of so I ;. The cell shown in the figure is having is having emf V and negligible internal resistance. The electric field as a function of x is best described by**



a) $\frac{2V}{l^2}x$ b) $\frac{2V}{PoL^2}x$ c) $\frac{V}{l^2}x$ d) none of these

10. **All batteries are having emf 10 volt and internal resistance negligible, All resistors are in ohms. Calculate the current in the right most 2Ω resistor.**

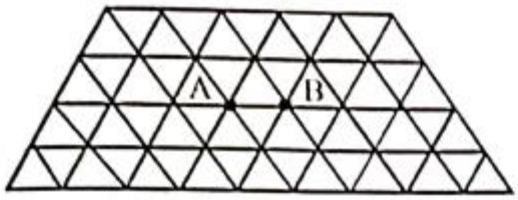


a) $\frac{25}{12}A$ b) $\frac{26}{6}A$ c) $\frac{12}{25}A$ d) $\frac{6}{25}A$

11. **I equal resistors are first connected in series and then connected in parallel. What is the ratio of the maximum to the minimum resistance'**

(a) n (b) $1/n^2$ (c) n^2 (d) 1/n

12. **There is an infinite wire grid with cells in the form of equilateral triangles. The resistance of each wire between neighbouring joint connections is R$_0$. The net resistance of the whole grid between the points A and B as shown is**

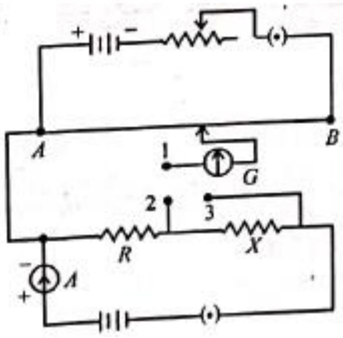


(a) R_0 (b) $\frac{R_0}{2}$ (c) $\frac{R_0}{3}$ (d) $\frac{R_0}{4}$

13. You are given a resistance coil and a battery. In which of the following cases is largest amount of heat generated?

a) When the coil is connected to the battery directly
b) When the coil id divided into two equal parts and both the parts are connected to the battery in parallel
c) When the coil is divided into four equal parts and all the four parts are connected to the battery in parallel.
d) When only half the coil is connected to the battery.

14. A potentiometer circuit is set up as shown. The potential gradient across the potentiometer wire, is k volt/cm and the ammeter. Present in the circuit, reads 1.0 A when two way key is switched off. The balance points ,when the key between the terminals (i) 1 and 2 (ii) 1 and 3 , is plugged in, are found to be at lengths 1_1 cm and I_2 cm respectively. The magnitudes, of the resistors R and X, in ohms, are then, equal, respectively, to

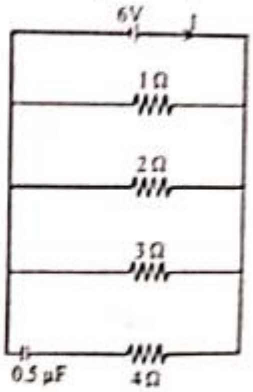


a) $K(l_2 - l_1)$ *and* Kl_2 b) Kl_1 *and* $K(l_2 - l_1)$
c) $K(l_2 - l_1)$ *and* $K\,l_1$ d) Kl_1 *and* $K\,l_2$

15. If voltage across a bulb rated 220Volts -100 watt drops by 2.5% of its rated value, the percentage of the rated value by which the power would decrease is:

a) 20% b) 2.5% c) 5% d) 10%

16. In the given circuit diagram the current through the battery and the charge on the capacitor respectively in steady state are



a) $1A\,and\,3\mu C$ b) $17A\,and\,0\mu C$ c) $\frac{6}{7}A\,and\,\frac{12}{7}\mu C$ d) $11A\,and\,3\mu C$

17. The length of a given cylindrical wire is increased by 100 % Due to the consequent decrease in diameter the change in the resistance of the wire will be

(a) 200% (b) 100% (c) 50% (d) 300%

18. Drift velocity V_d varies with the intensity of electric field as per the relation

a) $V_d \propto E$ b) $V_d \propto \frac{1}{E}$ c) V_d= constant d) $V_d \propto E^2$

19. The length of a wire of a potentiometer is 100cm. and the e.m .f of its standard cell is E volt. It is employed to measure the e.m.f of a battery whose internal resistance is 0.5Ω. if **the balance point is obtained at l=30 cm from the positive end, the e.m.f. of the battery is**

a) $\frac{30E}{100.5}$ b) $\frac{30E}{100.5}$ c) $\frac{30(E-0.5i)}{100}$ d) $\frac{30E}{100}$

20 The electric resistance of a certain wire of iron is R. It 1 its length and radius are both doubled, then

a) the resistance and the specified resistance, will both remain unchanged

b) the resistance will be double and the specific resistance will be halved

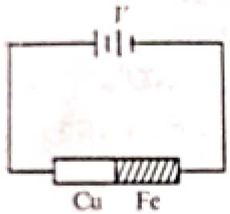
c) the resistance will be halved and the specific resistance will remain unchanged

d) the resistance will be halved and the specific resistance will be double

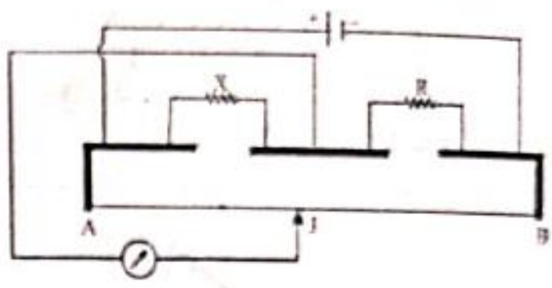
PART-II (NUMERICAL/INTEGER TYPE QUESTIONS)

21. A car battery has c.m.f 12 volt and internal resistance 5×10^{-2} ohm. If it draws 60amp current, the terminal voltage (in volt) of the battery will be

22. Two rods are joined end to end, as shown. Both have a cross-sectional area of $0.01 cm^2$. Each is 1 meter long. One rods is of copper with a resistivity of 1.7×10^{-6} ohm-centimeter, the other is of iron with a resistivity of 10^{-5} ohm-centimeter. How much voltage (in volt) is required to produce a current of 1 ampere in the rods?



23. The figure shows a meter-bridge circuit, X=12 Ω and R=18Ω. The jockey j is at the **null point. if R is made 8Ω.** Through the jockey j have to be moved by $4\times$A cm to obtain null point **again then find the value of A.**



24. A conducting wire of cross-sectional area 1cm^2 has 3 $\times 10^{23}$ charge carriers per m^3. If wire carries a current of 2 mA, then drift velocity (in m sec) of carriers is

25. A battery is charged at a potential of 15 V for 8 hours when the current flowing is 10 A. The battery on discharge supplies a current of 5A for 15 hours. The mean terminal voltage during discharge is 14 V. The "watt-hour" efficiency (in percent) of the battery is

KEY SHEET

26) **a**	27) **a**	28) **a**	29) **d**	30) **b**	31) **d**	32) **d**	33) **d**	34) **a**	35) **a**
36) **c**	37) **c**	38) **c**	39) **b**	40) **c**	41) **d**	42) **d**	43) **a**	44) **d**	45) **c**
46) **9**	47) **0.117**	48) **5**	49) 5×10^{-3}	50)					