ONE MARK QUESTIONS

1. ELECTRIC CURRENT

1. What is the resistance value of a resistor of colour code Brown, Black, Red and silver?

Sol: Brown-1, Black-0, Red-2, Silver- 10%.

Resistance, $R = 10 \times 10^{-2} \pm 10\Omega$.

2. Mention a non-ohmic device.

Sol: Semiconductor diode.

3. A wire of resistance R is stretched so that its length increases n times. What is its resistance?

Sol: When a wire of length l_1 and resistance R_1 is stretched to l_2, then new resistance is $R_2 = R_1(l_2/l_1)^2$. $R_2 = R(n)^2$ since $l_2 = nl_1$.

4. **Colour of the fourth band in a colour coded resistor is silver, what is its significance.**

Sol: The percentage by which the resistance could vary is 10%.

5. **Define ohm.**

Sol: The resistance of a conductor is said to be one ohm when a potential difference of one volt applied across its ends produces a current of one ampere.

6. **State Ohm's law.**

Sol: The current through a conductor is directly proportional to the potential difference between its ends provided temperature and other physical conditions remain constant.

7. **What is the practical unit of electric current?**

Sol: ampere.

8. **Write the expression for the current in a circuit containing a source of e.m.f. and external resistance.**

Sol: $I = E/(R+r)$

Where, E – emf of the cell, R – external resistance

r – internal resistance

9. **A current of 10ampere flows through a conductor of resistance 10ohms for 10seconds. How much charge is moved?**

Sol: current $I = Q / t$ or $Q = I t$

$= 10 \times 10 = 100C$

10. A uniform wire of resistance R is stretched uniformly so that its length is doubled. What is its new resistance?

Sol: Given $R_1 = R$; $l_2 = 2l_1$

using $R_2 = R_1(l_2/l_1)^2 = 4R$

11. What is the SI unit of resistivity?

Sol: ohm metre.

12. On what factors resistance of a conductor depends?

Sol: The resistance of a conductor depends on

i) area of cross section ii) length

iii) material of the conductor

13. **Relate resistance of a thermistor with temperature.**

Sol: $R = ae^{b/T}$

Where a and b are constant , T- temperature in kelvin

14. **The potential difference across the terminals of a cell of e.m.f. 1.1volt becomes 1volt when an external resistance of 1Ω is connected to its terminals. Find the internal resistance.**

Sol: Given V = 1V, R = 1Ω, E = 1.1V

Terminal potential difference,

$$V = \frac{ER}{R+r} \Rightarrow 1 = \frac{1.1\times 1}{1+r} \Rightarrow r = 0.1\Omega$$

15. **A current of 2ampere passes through a wire for 8seconds. Find the number of electrons passing across the wire (e=1.6 X 10^{-19}C)**

Sol: Given I = 2A, t = 8s, e = 1.6 X 10^{-19}C

current

$$I = \frac{Q}{t} = \frac{ne}{t} \Rightarrow n = \frac{It}{e} = \frac{2 \times 8}{1.6 \times 10^{-19}} = 10^{20} electrons$$

16. **Charge on an electron is 1.6 X 10^{-19}C. Find the number of electrons that should flow per second in a conductor to provide a current 1ampere.**

Sol: Given I = 1A, t = 1s, e = 1.6 X 10^{-19}C

current

$$I = \frac{Q}{t} = \frac{ne}{t} \Rightarrow n = \frac{It}{e} = \frac{1 \times 1}{1.6 \times 10^{-19}} = 6.25 \times 10^{18} electrons$$

17. **Which materials are used to make a good resistance coils?**

Sol: Alloys constantan and manganin.

18. **How does the resistance of a thermistor change with rise in temperature?**

Sol: Resistance of a thermistor decreases exponentially with increase in temperature.

19. **How does the electrical conductivity of a semiconductor vary with increase in temperature?**

Sol: Increases

20. **What amount of charge is conveyed through a conductor in 10microseconds, when a steady current of 5mA flows through it?**

Sol: I = 5 X 10^{-3}A, t = 10 X 10^{-6}s

$$I = \frac{Q}{t} \Rightarrow Q = It = 5\times10^{-3}\times10\times10^{-6} = 50\times10^{-9} = 50nC$$

21. **Two resistors of resistance 2Ω and 3Ω are connected in parallel and a p.d. is applied to the combination. Find the ratio of the current in two respective resistors.**

Sol: In parallel combination, $I\alpha\frac{1}{R} \quad \therefore \frac{I_1}{I_2} = \frac{R_2}{R_1} = \frac{3}{2}$

22. **A current of 3A flows through a resistance of 40Ω . Calculate the power consumed.**

Sol: I = 3A, R = 40Ω P = I2R = 9 X 40 = 360W

23. How does the resistance of a conductor vary with its area of cross-section?

Sol: Resistance is inversely proportional to the area of cross section.

24. A resistor (carbon) has a resistance of 120ohms. What is the colour sequence of the bands on it?

Sol:Given $R = 120\Omega = 12 \times 10^1\Omega$

i.e., Brown, Red, Brown.

25. Name a device which does not obey Ohm's law.

Sol: Semiconductor diode

26. What is meant by the internal resistance of a cell?

Sol: The resistance offered by the cell to the flow of current through it is called the internal resistance of the cell.

27. What is meant by Transition temperature?

Sol: The low temperature at which a material becomes a superconductor is called transition temperature.

28. When a material is called a superconductor?

Sol: When the material offers zero resistance it is called a superconductor.

29. **The colour sequence on a resistor is "Green-black-brown". What is the resistance?**

Sol: 500 20%Ω

30. **The colour of fourth band on a resistor is silver. What is the tolerance of the resistor?**

Sol: ± 10%

31. **Why is manganin used in making standard resistances?**

Sol: Since TCR of manganin is very low, their resistance do not vary much with temperature. Hence they are used in making standard resistance.

32. Expand ‘SQUIDS’.

Sol: Superconducting Quantum Interference Device.

33. What is a thermistor?

Sol: A thermally sensitive resistor is called a thermistor.

34. If the colour sequences of the resistor are brown, black, brown and gold, what is its resistance.

Sol: Brown	Black	Brown	Gold
1	0	10	± 5%

$R = 10 \times 10 \pm 5\% = 100 \pm 5\% \Omega$

35. **Define drift-velocity.**

Sol: The average velocity with which free electrons move in a conductor under the influence of an electric field is called drift velocity.

36. **What happens to the resistance of a thermistor when it is cooled?**

Sol: Increases

37. **What is critical field?**

Sol: The minimum magnetic field applied to the super conductor so that it changes from super conducting state to normal state at the given temperature is called critical magnetic field.

38. A current 2A flows through a conductor of resistance 4Ω. Calculate the potential difference across the conductor.

Sol: V = IR = 2 X 4 = 8V

39. Write the colour code for a resistor of resistance 120Ω .

Sol: Brown, Red, Black

40. Define resistivity of a conductor.

Sol: Resistivity of a material of the conductor is defined as the resistance of the conductor of unit length and unit area of cross section.

2. KIRCHHOFF'S LAWS

1. In a balanced Wheatstone's network galvanometer and cells are interchanged. Will the network be still balanced?

Sol: yes

2. What is the significance of Kirchhoff's second law?

Sol: The law is based on the principle of conservation of energy.

3. In a balanced Wheatstone's network the galvanometer is replaced by another of lower resistance, will the network be still balanced?

Sol: yes

[Reason: Balanced condition of wheatstone's network is independent of galvanometer resistance.]

4. What is a node in an electrical network?

Sol: A point where more than two conductors meet is called a node of an electrical network.

5. In a Wheatstone's network resistance P, Q, R and S are connected in a cyclic order, what is the balanced condition?

Sol: P/Q = S/R

6. In a balanced Wheatstone's network the galvanometer is replaced by another of higher resistance, will the network be still balanced?

Sol: yes

[Reason: Balanced condition of Wheatstone's network is independent of galvanometer resistance.]

7. In a balanced Wheatstone's network, the galvanometer resistance is increased by 20Ω . What happens to the balance of the network?

Sol: Balance of the network is not altered.

[Reason: The balance of the network is independent of the galvanometer resistance.]

8. Does the balancing condition of Wheatstone bridge vary, if the positions of the galvanometer and battery are interchanged?

Sol: No

3. MAGNETIC EFFECT OF CURRENT

1. At what angle should a proton enter a magnetic field for the force on it to be maximum?

Sol: 90^0. [Reason: Force on a moving charge in a magnetic field is $F = Bqv \sin\theta$. F will be maximum when $\theta = 90^0$.]

2. The plane of the coil of a TG is placed perpendicular to the magnetic meridian and an electric current is passed through it. What is the deflection of the needle in TG?

Sol: 0^0

3. Who discovered the magnetic effect of electric current?

Sol: Oersted

4. A TG gives a deflection of 30^0 for a certain current at one place and deflection of 45^0 at another place. Find the ratio of het horizontal components of the earth's field at the two places.

Sol:

$$\frac{B_1}{B_2} = \frac{\tan\theta_2}{\tan\theta_1} = \frac{\tan 45^0}{\tan 30^0} = \frac{1}{1/\sqrt{3}} = \sqrt{3} \quad \therefore \sqrt{3}:1$$

5. A circular coil has one turn and carries a current of qamp. The same wire is turned into a smaller coil of 4 turns and the same current is passed. What is the field at the centre of the wire?

Sol: 16 times the initial value

[Reason: As the number of turns increases by 4 times radius decreases by 4 times, therefore field increases by 16 times.]

6. What is the unit of magnetic induction?

Sol: tesla

7. Mention the law which gives the direction of the magnetic field in the region surrounding a straight current carrying conductor.

Sol: Right hand clasp rule

8. A circular coil carrying a certain current is rewound such that number of turns is halved. How does the magnetic field at the center of the coil changes?

Sol: $1/4^{th}$ of the initial vaule

[Reason: As the number of turns is halved radius increases twice, therefore magnetic field decreases to $1/4^{th}$ of the initial value.]

9. At which point on the axis of a solenoid, the magnetic field is the maximum?

Sol: At the center.

10. A current flows in a conductor from west to east. What is the direction of the magnetic field at a point below the conductor?

Sol: Towards north

11. At what angle should a high speed proton enter into a magnetic field so as to experience a maximum force?

Sol: 90^0. [Reason: $F = Bqv \sin\theta$. F will be maximum when $\theta = 90^0$.]

12. Name the law which gives the magnitude of he magnetic field at a point near a current element.

Sol: Laplace's law or Biot – Savart's law.

13. What is the magnitude of the force exerted of the force exerted on a charge which is moving along the direction of the magnetic field?

Sol: Zero

14. Does a neutron experience a force in a magnetic field?

Sol: No (because neutron is electrically neutral)

15. How does the magnetic field due to a current carrying conductor vary with current?

Sol: B α I, I – current through the conductor.

16. Define magnetic dip at a place.

Sol: It is defined as the angle between the direction of earth's total magnetic field to the horizontal direction at the place.

17. At which point on the axis of a circular coil carrying current, the magnetic filed is maximum?

Sol: Magnetic field is maximum at the center of the coil.

18. What are magnetic elements?

Sol: Earth's magnetic elements are;

i. **Horizontal component of earth's magnetic field.**
ii. **Dip or inclination**
iii. **Declination**

4. MECHANICAL EFFECT OF ELECTRIC CURRENT

1. What is a shunt?

Sol: A low resistance connected in parallel with the galvanometer is called a shunt.

2. Why an ammeter is always connected in series?

Sol: When ammeter is connected in series the entire current flows through it. When connected in parallel it measures a part of the main current.

3. Which is the basic instrument used to detect electric current?

Sol: Galvanometer.

4. How can a moving coil galvanometer converted into an ammeter.

Sol: By connecting a low resistance in parallel with the galvanometer.

5. What is the nature of the force between two parallel wires carry current in the same direction?

Sol: Attractive

6. What is the nature of the force between two parallel conductors carrying currents in opposite direction?

Sol: Repulsive

7. When did the two parallel conductors carrying current repel each other?

Sol: When the currents in the conductors are in the opposite direction.

8. What is the value of resistance of an ideal voltmeter?

Sol: Infinity

9. How can you convert a galvanometer into a voltmeter?

Sol: By connecting a high resistance in series with the galvanometer.

10. Give the expression for shunt required to convert a galvanometer into an ammeter.

Sol:

$$S = \frac{I_g G}{I - I_g}$$

I_g – current required for full scale deflection

G – galvanometer resistance

I – maximum current to be measured

11. An ammeter of resistance 0.1Ω reads upto 5A. Find the series resistance required to convert into a voltmeter to read upto 200V.

Sol: G = 0.1 Ω, I_g = 5A, V = 200V

$$R = \frac{V}{I_g} - G = \frac{200}{5} - 0.1 = 40\Omega$$

12. A galvanometer of resistance 10Ω is shunted with a resistance of 9Ω . What part of the main current flows through the galvanometer?

Sol: G = 10 Ω, S = 9 Ω

$$I_g = \left(\frac{S}{G+S}\right)I = \left(\frac{9}{19}\right)I = 0.47I$$

47% of main current.

13. What should be the resistance of an ideal ammeter?

Sol: Zero

14. A piece of soft iron is introduced into a magnetic field. How does the flux density change?

Sol: Increases

[Reason: Soft iron being a ferromagnetic substance increases the strength of the magnetic field.

15. Write the expression for the force experienced by a change moving in a uniform magnetic field?

Sol: $F = Bqv \sin\theta$ where, B – magnetic field, q – charge, v – velocity, θ – angle between B and v vectors.

16. What is the force acting on a charged particle moving parallel to a uniform magnetic field?

Sol: Zero [Reason: Force on a charged particle moving in a magnetic field is $F = Bqv \sin\theta$. When the particle moves parallel to the field $\theta = 0^0$. Therefore F = 0.

17. Can a stationary charged particle experience a force in a magnetic field?

Sol: No

5. ELECTROMAGNETIC INDUCTION

1. What is the phase relation between current and voltage in a AC circuit containing a pure inductance?

Sol: Voltage leads the current by an angle of 90^0

2. Does an inductor offer reactance to a steady current?

Sol: No. [Reason: Inductive reactance, X_L is proportional to the frequency of ac. For steady current, f = 0, therefore $X_L = 0$.]

3. Define coefficient of self induction.

Sol: Coefficient of self induction of a coil is equal to the emf induced in the coil, when the rate of change of current in it is unity.

4. What is a transformer?

Sol: A transformer is a device used to change the magnitude of the alternating voltage.

5. What is an induction coil?

Sol: Induction coil is a device used for obtaining a high unidirectional voltage from low voltage source.

6. What is mutual induction?

Sol: The phenomenon in which an emf is induced in one coil due to the change of current in the another coil is called mutual induction.

7. What is an AC?

Sol: The current which varies periodically with time is known as alternating current(AC).

8. What is the phase difference between current and voltage in a AC circuit containing pure capacitance.

Sol: Current leads the voltage by an angle of 90^0

9. The RMS value of the voltage in an AC circuit is 220V. Find its peak value?

Sol: Peak value $V0 = Vrms \times \sqrt{2} = 220 \times \sqrt{2} = 311.1V$

10. The peak value of a certain sinusoidal AC is 1.414amp. What is its RMS value?

Sol: R.M.S. value , $I_{rms} = \frac{I_0}{\sqrt{2}} = \frac{1.414}{\sqrt{2}} = 1A$

11. The current in a coil of self inductance 10mH changes from 0 to 15amp in 1 milli-sec. What is the emf induced in the coil?

Sol: Induced emf, $e = L\left(\frac{dI}{dt}\right) = \frac{10 \times 10^{-3} \times 15}{10^{-3}} = 150V$

12. Why is an electrical circuit carrying an AC a moving coil galvanometer cannot be used?

Sol: Deflection shown by the moving coil galvanometer will not be steady as current varies periodically.

13. What is the SI unit of self inductance?

Sol: henry

14. What is the significance of Lenz's law?

Sol: This law is an illustration of the law of conservation of energy.

15. What is the inductive reactance of a coil of inductance L when the frequency of an AC is 'f'?

Sol: $X_L = 2\pi fL$

16. The resonant frequency of a series LCR circuit is 100Hz. If the LC product is increased 16times, what is the new resonant frequency?

Sol: Resonant frequency, $f \alpha \frac{1}{\sqrt{LC}}$ **. If the LC product increased 16 times then**

$$f = \frac{100}{4} = 25Hz$$

17. What is the turns ratio of a transformer to change the voltage from 11,000V to 1,100V?

Sol:

$$\frac{n_p}{n_s} = \frac{V_p}{V_s} = \frac{11000}{1100} = \frac{10}{1} \quad \therefore 10:1$$

18. What is the meaning of the statement "Self inductance of a coil is Henry"?

Sol: Self inductance of a coil is said to be one henry if 1volt of emf induced when the rate of change of current in it is unity.

19. A d.c. voltage of 200V is applied to a coil of 100turns. What is the induced emf in the nearby coil of 50turns?

Sol: Zero. [Reason: No emf is induced in the secondary coil as there is no change in current in the primary coil.]

20. What is meant by the "Impedance" of an AC (LCR) circuit?

Sol: The effective opposition offered by L, C and R to the ac is called impedance of the circuit.

21. If X_c be the capacitive reactance of an AC circuit, what is the new capacitive reactance, when the frequency of the source is halved?

Sol: Capacitive reactance $X_c = \frac{1}{2\pi fC}$ **when f is halved, X_c doubles. Therefore "$2X_c$"**

22. Write the relation between root-mean-square (rms) value and the peak value of alternating current.

Sol: Root mean square value $I_{rms} = \frac{I_0}{\sqrt{2}}$

I_0 – peak value of current

23. How does the reactance of a capacitor in an AC circuit change if the frequency is increased?

Sol: Decreases. [Reason: Capacitance reactance

$$X_c = \frac{1}{2\pi fC} \Rightarrow X_c \alpha \frac{1}{f}]$$

24. What is wattless current?

Sol: Current flowing through an ac circuit in which power consumed is zero is called wattless current.

25. Give one advantage of AC over DC.

Sol: AC can be stepped up or stepped down.

26. Mention the principle on which a transformer works.

Sol: Transformer works on the principle of mutual induction.

27. Distinguish between resistance and inductance.

Sol: Resistance: Resistance of a conductor is defined as the ratio of p.d. across the conductor to the current to the current through it. Its unit is ohm.

Inductance: Inductance of a coil is defined as the emf induced in it when the current through it changes at unit rate. Its unit is henry.

28. What is eddy current?

Sol: Induced current is set up in a solid conductor when magnetic flux linked with it is varying. These currents are known as eddy current.

29. Write the expression for quality factor.

Sol: Quality factor of the LCR circuit is given by $Q = \frac{f_0}{f_2 - f_1}$

Where f0 is the resonant frequency and f2 and f1 are the frequencies at which the current falls to $\frac{1}{\sqrt{2}}$ **times the maximum value.**

30. State Lenz's law.

Sol: Lenz's law states that the direction of induced current is such that it tends to oppose the change that produces it.