- Point form :∇x H = J
- The magnetic flux density $\overline{\boldsymbol{B}}$ is analogous to the electric flux density $\overline{\boldsymbol{D}}$. The relation between $\overline{\boldsymbol{B}}$ and $\overline{\boldsymbol{H}}$ is which is through the property of medium called permeability μ. The relation is given by,

$$\overline{\boldsymbol{B}} = \boldsymbol{\mu}\overline{\boldsymbol{H}}$$

- For free space μ=μ0= 4π x 10^{-7} H/m hence, $\overline{\boldsymbol{B}} = \boldsymbol{\mu 0}\overline{\boldsymbol{H}}$
- The magnetic flux density has unitswb/m^2 and hence it can be defined as the flux in webers passing through unit area in a plane at right angles to the direction flux.
- Magnetic flux density (B) =Magnetic flux area=AΦ webers /m^2 (Tesla)

TWO MARKS

1. Define Magnetic flux density.

   The total magnetic lines of force i.e. magnetic flux crossing a unit area in a plane at right angles to the direction of flux is called magnetic flux density. It is denoted as *B* .Unit Wb/m2.

2. State Ampere's circuital law.

   The line integral of magnetic field intensity *H* equal to the direct current enclosed by that path. around a closed path is exactly

   The mathematical representation is $\int H.dL = I$.

3. Define Magnetic field Intensity.

   Magnetic Field intensity at any point in the magnetic field is defined as the force experienced by a unit north pole of one Weber strength, when placed at that point. Unit: N/Wb (or) AT /m.It is denoted as r .

4. What is rotational and irrotational vector field?

   If curl of a vector field exists then the field is called rotational. For irrotational vector field, the curl vanishes i.e. curl is zero.

5. What is the relation between magnetic flux density and magnetic field Intensity.

$$\overline{\mathrm{B}} = \mu\overline{\mathrm{H}}$$

   Where

   B - Magnetic flux density (Tesla)
   H - Magnetic Field Intensity (A/m)
   μ0 - Permeability of free space
   μr - Relative permeability of medium

6. State Biot Savart Law.

   The Biot Savart law states that, The magnetic field intensity *dH* produced at a point p due to a differential current element IdL is

   - Proportional to the product of the current I and differential length dL
   - The sine of the angle between the element and the line joining point p to the element
   - And inversely proportional to the square of the distance R between point p and the element *dH*

$$dH = \frac{\mathrm{Idl}sin\,\theta}{4\pi r^2}$$

7. What is a capacitor?

A capacitor is an electrical device composed of two conductors which are separated through a dielectric medium and which can store equal and opposite charges ,independent of whether other conductors in the system are charged or not.

8. What is drift current and convection current?

The current constituted due to the drifting of electrons in metallic conductor is called drift current. While in dielectrics, there can be flow of charges, under the influence of electric field intensity. Such a current is called convection current.

9. State the principle of conservation of charge.

The principle of conservation of charge is, the charges can neither be created nor be destroyed.

10. What is drift velocity?

Under the effect of applied electric field, the available free electrons start moving. The moving electrons strike the adjacent atoms and rebound in the random directions. This is called drifting of the electrons. After sometime, the electrons attain the constant average velocity called drift velocity.

11. Define Magnetic dipole moment.

The Magnetic dipole moment of a current loop is defined as the product of current through the loop and the area of the loop, directed normal to the current loop.

12. Define scalar magnetic Potential.

The concept of electric potential that simplified the computation of electric fields for certain types of problems. In the same manner let us relate the magnetic field intensity to a scalar magnetic potential and write: $\overline{H} = -\nabla V_m$

13. State Stokes Theorem

The line integral of a vector around a closed path is equal to surface integral of the normal component of its equal to the integral of the normal component of its curl ever any closed surface.

$$\oint H.dl = \iint \nabla x H \, ds$$

14. What is the maximum torque on a square loop of 1000 turns in a field of intensity of 1 Tesla. The loop has 10 cm sides and carries 3A. What is magnetic moment of loop?

Solution:

N = 1000
a = 0.1 m
I = 3A
B = 1 Tesla
Area = 0.01m2

Torque = IAB
= 3 x 0.01 x 1
= 0.03 N-m

Magnetic Moment = IA
= 3 x 0.01
= 0.03 Amp. m^2

15. Point Form Of Ampere's Circuital Law

Point Form Of Ampere's Circuital Law $\nabla \times H = \frac{\partial D}{\partial t}$

16. Write the Applications of Amperes circuital Law
    Applications of Amperes circuital Law
    - $\bar{H}$due to infinitely long straight conductor
    - $\bar{H}$ due to co axial cable
    - $\bar{H}$ due to infinite sheet of current
17. What are the steady magnetic field laws
    a. Biot Savart Law
    ii. Point form of Ampere Circuital Law

QUESTION BANK

1. State and explain Biot-savart's law.
2. Obtain the expression for magnetic field intensity due to infinite long straight wire carrying a steady current I.
3. Derive the expression for H due to finite length wire carrying a steady current I.
4. Derive the expression for H due to square loop carrying current I at the centre.
5. State and prove Ampere's circuital law.
6. Explain about the applications of Ampere's circuital law.
7. Write out note on vector and scalar potential.
8. Explain about Stokes theorem
9. Derivation of Steady magnetic field Laws.
10. An iron ring with a cross sectional area of 3cm square and mean circumference of 15cm is wound with 250 turns wire carrying a current of 0.34A. The relative permeability of ring is 1500. Calculate the flux established in the ring.

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