Student name: syed bashir ahmad shah

Student ID: 12996

Final Term Examination

Subject Name: Applied Physics
Class: BS SE-1, CS-1
Instructor: M Khalid Hamid
Total Marks: 50

Note: Attempt all Questions

Q1:

a. How to calculate the magnetic force on current carrying wire? (10 marks)

Answer: Calculating Magnetic Force on a Current-Carrying Wire

Calculate the force on the wire, given $B=1.50\ T$, $l=5.00cm$ and $I=20.0A$.

The force can be found with the given information by using $F=IlBsin\theta$ and noting that the angle θ between l and B is 90°, so that $sin\theta=1$

Solution

Entering the given values into $F=IlBsin\theta$ yields

$$F=IlBsin\theta=(20.0A)(0.0500m)(1.50T)(1)$$

The units for tesla are $1T=N/A.\ M$; thus,

$$F=1.50N$$

This large magnetic field creates a significant force on a small length of wire.

b. What is the difference between Resistance and Resistivity?

Answer: Resistance:

- The electrical resistance of an object is a measure of its opposition to the flow of electric current.
- It depends upon the length, area of cross-section and nature of the material of the given material, and physical conditions like temperature.
- Its SI unit is ohm.
- It is denoted by R.

Resistivity:

- Resistivity is the characteristics property of the material by which it resists the amount of current through it.
- It only depends upon the nature of the material and physical conditions like temperature.
- Its SI unit is ohm meter.
- It is denoted by p(rho).

Q2:

a. What is the difference between reflection and refraction? (10 marks)

Answer: Reflection: Reflection is the phenomenon in which light reflects back after striking a smooth surface.

In reflection, the ray which strikes the smooth surface is called reflected ray. The angle in between the incident ray and the normal ray is called angle of incidence and the angle between the normal ray and reflected ray is called the angle of reflection.

Refraction: Refraction is the process in which, when the incident ray strikes the surface in some medium and it gets diverted or bent while passing through another medium.

The ray generally bends towards the normal ray while traveling to rarer medium to a denser medium and it bends away from normal ray while traveling to denser to rarer medium.

b. Explain the difference among angle of incident, angle of reflection and angle of refraction with the help of formulae and a single diagram?

Answer: The angle which an incident line or ray makes with a perpendicular to the surface at the point of incident is called angle of incidence.

The angle made by a reflected ray with a perpendicular to the reflecting surface is called angle of reflection.

The angle made by a refracted ray with a perpendicular to the refracting surface is called angle of refraction.

Q3:

a. Find the difference between electric potential energy and electric potential? (10 marks)

Answer: The basic difference between electric potential and electric potential energy is that electric potential at a point in an electric field is the amount of work done to bring the unit positive charge from infinity to that point, while electric potential energy is the energy that is needed to move a charge against the electric field.

The gravitational potential at a point in the gravitational field is the gravitational potential energy of a unit mass placed at that point. In this way, the electric potential energy at any point in the electric field is the electric potential energy of a unit positive charge at that point.

If W is the work done in moving a unit positive charge q from infinity to a certain point in the field, the electric potential V at this point is given by:

V = W/q

It implies that electric potential is measured relative to some reference point and like potential energy we can measure only the Change in potential between two points. Electric potential is the scalar quantity. Its unit is volt which is equal to joule per coulomb (J/C).

The unit of electric potential is volts.

The unit of electric potential energy is joules.

b. How to find the potential difference between any two points in the electric field lines?

Answer: *" A potential difference of one volt exists between two points when one Joule of work is required to move one Coulomb of charge from one point to the other"*

Between two points A and B we may write

$$W_{AB} = -V_{AB}q$$

where $V_{AB} = V_B - V_A$ is the potential difference between A and B.

Note that W_{AB} is the work done by the electric field in moving the charge. The work done by the "external agent" is $-W_{AB}$.

Units of potential difference are volts

1 Volt = 1 Joule/Coulomb (J/C)

In a region of space where there is an electric field the work done by the electric field, dW, when a positive point charge, q, is displaced by **ds** is given by,

$$dW = q\vec{\mathbf{E}} \cdot \mathbf{ds}$$

Therefore,

$$\Delta V = V_{AB} = V_B - V_A = -\frac{W_{AB}}{q} = -\frac{\int_A^B q\mathbf{E} \cdot \mathbf{ds}}{q} = -\int_{\mathbf{A}}^{\mathbf{B}} \mathbf{E} \cdot \mathbf{ds}$$

For a uniform electric field we obtain,

$$\Delta V = -\int_A^B E \cdot ds = \int_A^B E\, ds = E\int_A^B ds = E\Delta s$$

where an arbitrary path can always be split into sections along **E** and sections perpendicular to **E**.

Note that this means that the electric field can be expressed in the units V/m. [1 N/C = 1V/m]

The electric field is a **conservative field**.

This means that the potential difference between two points is independent of the path taken. Every point in space has a single value of V and E.

Q4:

a. Compare the depletion regions in forward bias and reverse bias? (10 marks)

Answer: Forward bias:

- Positive terminal of battery is connected to P-type and negative terminal to n-type semiconductor.
- Depletion layer is very thin.
- P-n junction offers very low resistance.
- An ideal diode have zero resistance.

Reverse bias:

- Positive terminal of battery is connected to n-type and negative terminal to P-type semiconductor.
- Depletion layer is thick.
- P-n junction offers very high resistance.
- An ideal diode have infinite resistance.

The forward bias decreases the resistance of the diode whereas the reversed bias increases the resistance of the diode. In forward biasing the current is easily flowing through the circuit whereas reverse bias does not allow the current to flow through it.

b. How reverse breakdown occur in a diode?

Answer: When we increase the reverse voltage across the pn junction diode, what really happens is that the electric field across the diode junction increases (both internal and external). This results in a force of attraction on the negatively charged electrons at junction. Normally, the reverse current is so small that it can be neglected. If the external reverse-bias voltage is increased to a value(50 V or larger), at this stage the reverse breakdown occurs.

Q5:

a. Explain the Magnetic field of solenoids? (10 marks)

Answer: A solenoid is a coil of wire designed to create a strong magnetic field inside the coil. By wrapping the same wire many times around a cylinder, the magnetic field due to the wires can become quite strong. The number of turns N refers to the number of loops the solenoid has. More loops will bring about a stronger magnetic field. The formula for the field inside the solenoid is

B = m0 I N/L

This formula can be accepted on faith, or it can be derived using ampere's law.

The magnetic field inside a solenoid is proportional to both the applied current and the number of turns per unit length. There is no dependence on the diameter of the solenoid, and the field strength doesn't depend on the position inside the solenoid, i.e the field inside is constant.

b. Explain the Magnetic field of Toroids?

Answer: If a solenoid is bent in a circular shape and the ends are joined, we get a toroid. Alternatively, one can start with a nonconduncting ring and wind a conducting wire closely on it. The magnetic field in such a toroid can be obtained using ampere's Law.

The magnetic field in the open space inside (point P) and exterior to the toroid (point Q) is zero. The field B inside the toroid is constant in magnitude for the ideal toroid of closely wound turns.

The direction of the magnetic field inside is clockwise as per the right hand thumb rule for circular loops.