Question Bank
4-Magnetic effects of current

LEVEL A

1 Mark Questions

1) State Biot-Savart's law in vector form.
2) What is the SI unit of magnetic flux density?
3) Define Tesla.
4) A compass placed near a current carrying conductor is not aligned along earth's magnetic axis.Why?
5) How does the magnetic field in a solenoid change when current through it is increased?
6) Sketch the magnetic field lines through a solenoid.
8) Why is the magnetic field in a moving coil galvanometer radial?
9) What is a galvanometer?
10) Define current sensitivity of a galvanometer.
11) Define Voltage sensitivity of a galvanometer.
12) How can you convert a galvanometer into an ammeter?
13) How can you convert a galvanometer into a voltmeter?
14) What is the resistance of an ideal ammeter?
15) What is the resistance of an ideal voltmeter?
16) How should an ammeter be connected in a circuit?
17) How should a voltmeter be connected in a circuit?

2 Mark Questions

1) A charged particle q is moving in a uniform magnetic field $\vec{B}$ with a velocity $\vec{V}$. Show that the network done on the changed particle by the magnetic field is Zero.
2) A changed particle q enter a magnetic field at right angles to the magnetic field.Obtain an expression for radius of path.
3) A cyclotron uses small electric field, yet accelerates the charged particles to very high velocities. How?
4) Explain the symbols in the equation $\vec{F} = q(V \times B)$ which are the two pairs of vectors always perpendicular to each other.
5) The coil of a galvanometer has a resistance of 100 ohm.It shows a full scale deflection for a current of 5×10^{-4} A How will you convert it into a voltmeter reading a maximum potential difference of 5 volts.

3 mark questions

1) A rectangular coil of n turns and area of cross section A is placed in a uniform magnetic field B with the area vector making an angle ∅ with B.Derive an expression for torque on the coil.
2) A galvanometer coil of 50 ohm resistance shows full scale deflection for a current of 5 mA. How will you convert this galvanometer into a voltmeter of range 0 – 15 V?

5 mark question

1) Describe the theory and working of a cyclotron with the help of a labeled diagram. Why an electron can not be accelerated using cyclotron.

2) Find an expression for the force on a moving charge in a magnetic field. State Fleming's left hand rule. Find the force on a moving charge when (i) moving parallel or anti parallel to the field (ii) moving at right angle to the field and (iii) at rest. Also give the definition of unit magnetic field.

3) State and explain Biot-Savart law. Using it derive an expression for the magnetic field at a distance from a straight infinitely long current carrying conductor .

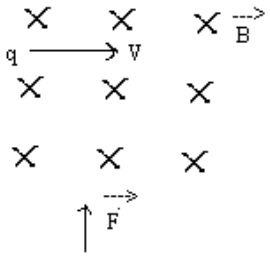
4) Derive the equation for magnetic field due to a circular coil carrying current (a)at a point on its axis.(b) at its centre

5)Derive an expression for the force between two straight parallel current carrying conductors of infinite length and hence define one ampere.

LEVEL B

1 Mark Questions

1) What is the direction of force on a charge q moving the direction as shown in the diagram?



2) A charge is moving in a uniform magnetic field, what should be the direction of movement for the force to be maximum/minimum?

3) Why should an ammeter have a low resistance?

4) Define figure of merit of a galvanometer.

5) What is the relation between Tesla and Guass?

6) Mention two limitations of a cyclotron.

7) What is the function of soft iron cyclinder in a moving coil galvanometer?

8) An electron beam moving with uniform velocity diverges at low velocities, but converages at high velocities. Why?

9) Why does a solenoid contract when current is passed through it?

10) State Fleming's left hand rule.

2 Marks Questions

1) A beam of α - particles and of proton of same velocity V enter a uniform magnetic field at right angles to the field lines. The particles describe circular paths. What is the ratio of their radii?
2) Derive an expression for frequency oscillation of electric field in a cyclotron.
3) Show that two infinitely long parallel conductor carrying current in the same direction attract each other.
4) Derive an expression for magnitude of force per unit length between two long parallel conductors carrying current i_1 and i_2 separated by a distance of d meter.

3 Mark Questions

1) A rectangular coil of n turns and area of cross section A is placed in a uniform magnetic field B with the area vector making an angle $\varnothing$ with B.Derive an expression for torque on the coil.
2) State the principle of a moving coil galvanometer Derive an Expression for the current sensitivity of the moving coil galvanometer.
3) Derive expression for shunt resistance and series resistance needed to convert a galvanometer into an ammeter and a voltmeter respectively.
4) To increase the current sensitivity of the moving coil galvanometer by 50 % its sresistance is increased so that the new resistance becomes twice its initial resistance. By what factor does its voltage sensitivity change ?

LEVEL C

1 Mark Questions

1. Out of Voltmeter and Millivoltmeter, which has the higher resistance?

2. Out of Ammeter and Milliammeter, which has the higher resistance?

3. An electron moving with Kinetic Energy 25 keV moves perpendicular to a uniform magnetic field of 0.2 mT. Calculate the time period of rotation of electron in the magnetic field.

4. An electron is revolving around the nucleus of an atom in an orbit of radius 0.53 Å. Calculate the equivalent magnetic moment, if the frequency of revolution of the electron is 6.8 x 10 9 MHz.

5. A proton, alpha particle and deuteron are moving in circular paths with same kinetic energies in the same magnetic fields. Find the ratio of their radii and time periods.

6. What is the work done by the magnetic force on a charged particle moving perpendicular to the magnetic field?

7. An electron beam is moving vertically upwards. If it passes through a magnetic field directed from South to North in a horizontal plane, in what direction will the beam be deflected?

8. Why does the picture of T V screen become distorted when a magnet is brought near to the T V Screen?

2 Mark Questions

1)Suppose a helical spring is suspended from the roof of a room and very small weight is attached to its lower end what will happen to the spring when a current is passed through it?Give reason to support your answer?

2. One alpha particle and a deuteron entered perpendicularly in a uniform magnetic field with same velocity. Which one follow the greater circle?

3. The pole of a magnet is brought near to a stationary charge. What will be the force experienced by pole?

4. Proton is moving along the axis of a solenoid carrying current of 2 A and 50 number of turns per unit length. What will be the force acting on the particle.

5. Can a Moving Coil Galvanometer can be used to detect an A.C. in a circuit .Give reason

6. A charged particle of mass 5 mg and charge q = 2 μC has velocity v= 2i – 3j + 4k. Find out the magnetic force on the charged particle and its acceleration at this instant due to the magnetic field B = 3j – 2k. B and v are in Wb/sq. m and m/s respectively.

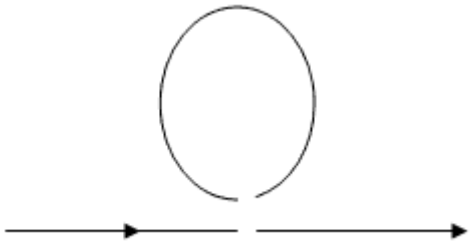
3 marks questions

1). Two wires of equal length are bent in the form of two loops. One loop is square whereas the other is circular. These are suspended in same magnetic field and same current is passed through them. Explain with reason which will experience greater torque?

2) A circular coil of 30 turns and radius 10cm carrying a current of 5A is suspended vertically in a uniform horizontal magnetic field of 100G. The field lines make an angle of 60o with the normal to the coil. Find the torque acting on this coil. Would the answer change if instead of the circular coil , we had a square coil but with the same area?

3) An alpha particle and a proton are accelerated by the same potential difference of 50V and enter a magnetic field of 100T perpendicular to their velocity. What kind of path will they trace in the magnetic field. Find the ratio of their radius and time period

4) Find the magnetic field at the center of the Circle of radius 2m, if 5A current is flowing in the Direction shown. The wire is assumed to be very long.



5). A rectangular (10cm x 5cm) and having 1000 turns with a current of 2A is placed in a uniform magnetic field of 100 Gauss directed along the positive x axis. Due to the magnetic field a torque will act on it. Under what conditions will this torque be maximum and when will it be minimum.

6) A particle of mass 50gm has a charge of 2mC. The region consists of a uniform magnetic field of 500G directed into the plane. The particle enters the region with a velocity of 250m/s towards north. Using a figure show the path of the particle and find the following

a. Force acting on the particle
b. Radius of its path
c. Time period of its motion
d. Frequency

7). An infinite wire carries a current of 4A in the South to North direction. Find the magnetic field at a point 5m to the east of this wire. Give the direction of the field.

8). A circular coil of radius 50cm has 10 turns and carries a current of 5mA. A soft iron piece of relative permeability 800 is kept inside it. Find the magnetic induction at its centre.

5 marks questions

1)Deduce the expression for magnetic dipole moment of an electron revolving around a nucleus in a circular orbit.Indicate the direction of magnetic dipole moment?Use the expression to derive the relation between the magnetic moment of an electron moving in a circle and its related angular momentum

2)What is a radial magnetic field? Draw diagram to illustrate how is it realised in a moving coil galvanometer. What is the advantage of a radial magnetic field in MCG?