PROBLEMS FOR PRACTICE

SECTION – I

1. A proton (charge + 1.6×10^{-19} C) moving in the XY plane with a velocity of 6×10^7 m/s makes an angle of 30° with a uniform magnetic field of induction B = 1.5 T acting along the positive direction of Y-axis. Find the force acting upon it. **(7.2×10^{-12} N)**

2. A proton moving with a speed of 5×10^6 m/s is subjected to a magnetic field of 0.4 T inclined at 30° to the direction of velocity of the proton. What is the acceleration of the proton? Mass of proton = 1.6×10^{-27} kg. **(10^{14} m/s^2)**

3. Find the magnitude of the force acting on a straight conductor one metre long carrying a current of 2.5 A and kept at right angles to a uniform magnetic field of induction 0.36×10^{-4} Wb/m^2. **(9×10^{-5} N)**

4. Find the force acting on a straight conductor 5m long and carrying a current of 5A when kept inclined at an angle of 30° to a uniform magnetic field of induction 10^{-3} Wb/m^2. **(1.25×10^{-2} N)**

5. An infinitely long straight wire carries a current of one ampere. How should it be kept and in what direction the current should flow through it so that the magnetic field it produces is balanced by earth's horizontal magnetic field of 0.36×10^{-4} T? Find the shortest distance of this point from the wire. **(5.5×10^{-3} m)**

6. Two parallel wires are 2 cm apart and carry currents of 30 A and 40 A in the same direction. Find the force they exert on each other if the length of each is 10 cm. **(12×10^{-4} N)**

7. Two straight wires, each 10 cm long, are parallel to one another and each carries a current of 40A. What force is experienced by either wire when separated by a distance of 20 cm currents flowing in the (a) same (b) opposite direction ? **(16×10^{-5} N)**

8. The distance between two long and thin parallel straight wires P and Q is 4 cm. The wires carry currents of 8A and 5A in the same direction. What is the force acting on a 10 cm section of wire P? **(2×10^{-5} N towards Q from P)**

9. Find the magnetic induction at the centre of a circular coil of wire of 50 turns and of average radius 6.284 cm when a current of 0.3 A is passed through the coil. **(1.5×10^{-4} Wb/m^2)**

10. Find the magnetic induction at the centre of a circular coil of radius 0.1 m having 50 turns and carrying a current of 500 mA. **($5\pi \times 10^{-5}$ Wb/m^2)**

11. When a current of 2A is set up in a circular coil of mean radius 15.7 cm, the magnetic induction produced at the centre of the coil is 2×10^{-4} Wb/m^2. Find the number of turns in the coil **(25)**

12. Magnetic induction at the centre of a circular current- carrying coil of wire is 10^{-4} Wb/m^2. The number of turns in the coil is 50 and the average radius of the coil is 2 cm. Find the current in the coil. **(0.0637 A)**

13. Through a coil of radius 5 cm and 10 turns, a 5A current is passed. Find the magnetic induction it produces at a point on its axis 12 cm from the centre of coil. **(3.6×10^{-5} Wb/m^2)**

14. A circular coil has one turn and carries a current of 1 A. The wire is turned into a 4 turn coil of smaller radius and the same current passed through it. What will be the magnetic field at the centre? **(16 times initial value)**

15. A circular coil carries a current of 1A. The wire is rewound to reduce the number of turns to half. How does the magnetic field at the centre of the coil change? **(Decreases to $\frac{1}{4}$th)**

16. A current of 5A flows through a circular coil of 500 turns and radius 5 cm. Find the magnetic field at the centre of the coil. What is the magnetic field at a point 12 cm away from the centre of the coil? **(3.142×10^{-2} T ; 1.786×10^{-3} T)**

17. The number of turns in a circular coil of wire is 8 and the average radius of each turn is 8 cm. A current of 5 A is passed through the coil. Find the magnetic induction due to the current at a point distant 6 cm on the axis of the coil from its centre. **(1.6×10^{-4} Wb/m^2)**

18. The intensity of magnetic field at the centre of a circular coil carrying an electric current of 7A is 6.6×10^{-4} Wb/m^2. Find the number of turns in the coil which has an average diameter of 20 cm. **(15)**

19. A circular coil of radius 15 cm carries a steady current. Find the distance of a point on its axis at which the magnetic induction is half that at the centre. (Take $\sqrt{2^{2/3} - 1} = 0.8$) **(12 cm)**

20. The magnetic flux densities at two points on the axis of a circular coil of wire carrying an electric current are in the ratio 8 : 1 at distances of 5 cm and 20 cm from the centre of the coil. Find the diameter of the coil. **(0.2 m)**