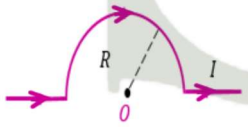
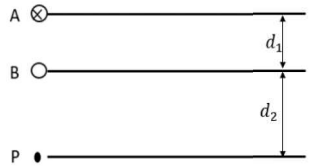
c) A straight horizontal rod of length 20 cm and mass 30 gm is placed in a uniform horizontal magnetic field perpendicular to the rod. If a current of 2A through the rod makes it self-supporting in the magnetic field, calculate the magnetic field.

d) A horizontal straight wire 5 cm long weighing 1.2 gm^{-1} is placed perpendicular to a uniform horizontal magnetic field of flux density of 0.6 T. IF the resistance per unit length of the wire is 3.8 Ωm^{-1}, calculate the p.d. that has to be applied between the ends of the wire to make it just self-supporting.

3. a) Discuss the torque produced on a rectangular current carrying coil placed in a uniform magnetic field.
   b) Discuss the cases when the torque is maximum and minimum.
   c) The plane of a $5cm \times 8cm$ rectangular loop of wire is parallel to a $0.19T$ magnetic field. The loop carries a current of $6.2A$. What torque acts on the loop?
4. What is the principle of moving coil galvanometer? In moving coil galvanometer,
   a) Cylindrical magnets are used, why?
   b) What is the use of soft iron core?
   c) The coil of a moving coil galvanometer has 50 turns and its resistance is 10Ω. It is replaced by a coil having 100 turns and resistance 50Ω. Find the factor by which voltage sensitivity changes.
5. The Hall effect in metal offered the first real proof that electric currents in metals are carried by moving electrons, not by protons.
   a) What is Hall effect? Deduce the expression for hall voltage.
   b) Hall voltage in a semiconductor is more than that in metals, why?
   c) A strip of metal is 10 mm wide and 2 mm thick. It carries a current of 6 A, and is placed so that a magnetic field of 0.09 T is passing at right angles through it surface. The metal has 8×10^{28} charge carriers per cubic meter. Calculate the velocity of the charge carriers, and the Hall voltage that would be produced.
6. Biot-Savart Law Is used to find magnitude of magnetic field due to a current carrying conductor of any shape and size.
   a) State Biot-Savart's law. Obtain the expression for magnetic field due current carrying circular loop at its center.
   b) A wire of length 62.8m carrying current 10A is bent into a circular coil of radius 10 cm. Find the magnetic field at the center of the coil.
   c) A semi-circular wire of radius 9.26 cm has two radial segments each of length $13.1cm$, as shown in the figure. If the current in the wire is 32.3 mA, find the magnitude and direction of the net magnetic field at the center of curvature O of the semicircle.



   d) A circular coil has 100 turns and a mean diameter of $20cm$. It carries a current of $5A$. Find the strength of the magnetic field at a point on its axis at a distance of $15cm$ from the center of the coil.
   e) A current carrying solenoid is considered as a bar magnet? Explain.
   f) Relate magnetic field intensity due to current carrying solenoid at its center with that at its end.
   g) A horizontal wire of length $5cm$ and carrying a current of $2A$, is placed in the middle of a lone solenoid at right angles to its axis. The solenoid has 1000 turns per meter and carries a steady current I. Calculate I if the force on the wire is equal to $10^{-4}N$.
7. Ampere's Circuital law is the alternative method to Biot-Savarts law to calculate magnitude of magnetic field,
   a) State Ampere's circuital law.
   b) Find Magnetic field due to straight current carrying conductor.
8. When two current carrying straight conductors are brought nearer to each other, they experience force either attractive or repulsive.
   a) Explain the attraction and repulsion of conductors in accordance with the direction of current flow in the wire.
   b) Define one amperes current in terms of force.
   c) Explain why a current carrying solenoid tends to contract.
   d) Two long parallel conductors carry respectively currents of 12A and 8A in the same direction. If the wires are 10cm apart, find where a third parallel wire also carrying a current must be placed so that the force experienced by it will be zero.
   e) Two long parallel transmission lines, 40 cm apart carry 25 A and 75 A current. Find location where the net magnetic field of these two wires is zero if these currents are in the (a) same direction (b) in opposite direction.
   f) Two long straight wires separated by a distance $d_1 = 0.75cm$ are perpendicular to the page as shown in figure. The direction of current in the wire A is into the page which is shown by $(\times)$ and current carried by it is $6.5A$. What are the (o) magnitude and direction (into or out of page) of the current in wire B if the net magnetic field due to two currents is zero at point P located at a distance $d_2 = 1.50cm$ from wire B.



Magnetic Properties of a material:

Magnetic Permeability: *The degree to which magnetic lines of force can penetrate a substance placed in the magnetizing field.*

Magnetic Susceptibility: *It is a measure of how easily and strongly a material can be magnetized.*

Magnetizing Field Intensity or Magnetic Intensity (H): *It is the degree to which a magnetic field can magnetizes a material.*

Intensity of Magnetization (I): *The intensity of magnetization represents the extent to which a specimen is magnetized when placed in a magnetizing field.*

Diamagnetic Material *are weakly magnetized in a direction opposite to that of applied magnetic field. Magnetic properties of such materials are independent to temperature. E.g. copper*

Paramagnetic Material *are weakly magnetized in a same direction to that of applied magnetic field. Magnetic properties of such materials are decreases with increase in temperature. E.g. Aluminum*