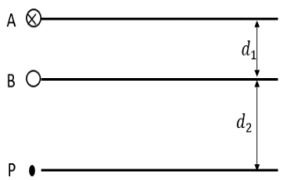
a) State Biot-Savart's law. Obtain the expression for magnetic field due current carrying circular loop at its center.
b) A wire of length 62.8m carrying current 10A is bent into a circular coil of radius 10 cm. Find the magnetic field at the center of the coil.
c) An electron is revolving around its orbit of radius $5x10^{-11}$m with a frequency of $2x10^{10}Hz$. Calculate magnetic field at its center.
Calculate the magnetic field at the center of coil in the form of square of side 4 cm carrying a current of 5A.
d) 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.
e) A coil consisting of 100 circular turns with radius 60 cm carries a current of 5A. Find the magnetic field at a point along the axis of the coil, 80 cm from the center. [1.13x10^-4T]

Day-10

8. 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, a long solenoid and toroid.
   c) A toroid has a core of inner radius 20cm and outer radius 25 cm around which 1500 turns of a wire are wound. If the current in the wire is 2A. Calculate the magnetic field inside and outside the toroid. (0.003T, 0)

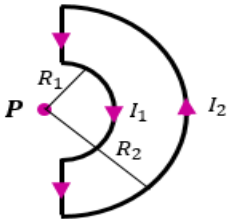
Day-11 & 12

9. 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 ampere 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.



Additional Questions

1. An electron beam and a proton beam are moving parallel to each other in the beginning. Do they always maintain this status?
2. How will the magnetic field intensity at the center of a circular coil carrying current change, if the current through the coil is doubled and the radius of the coil is halved?
3. Use the Biot-Savarts law to determine the magnitude and direction of the magnetic field at the common center **P** of two concentric wire arcs of radii $R_1 = 0.3\ m$ and $R_2 = 0.6\ m$ that are connected by the straight segments. The two wires that form the arcs carry unequal currents: $I_1 = 10A$ and $I_2 = 15A$.



4. A current of $0.5A$ is passed through a rectangular section of a semiconductor $4\ mm$ thick which has majority carriers of negative charges of free electron. When magnetic field of $0.2T$ is applied perpendicular to the section, a Hall voltage of $60mV$ is produced between the opposite edges. Calculate the number of charge carriers per unit volume?
5. A horizontal wire of length $5\ cm$ and carrying a current of $2A$, is placed in the middle of a long solenoid at right angles to the 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 $10^{-4}N$.
6. An electron is moving northward with a velocity of $10^7 m/s$ in a magnetic field of 3T directed eastward Calculate the magnitude and direction of the force on the electron.
7. Circular loop of a wire and an infinitely long straight wire carries currents I, and I' respectively as shown in fig. Assuming that these are placed in the same plane. The net magnetic field will be zero at the center of the loop. Find the value of X.