8.1 - Magnetic Fields

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- (2000) A proton is moving in a uniform magnetic field B . Draw the diagram representing B and the path of the proton if its initial direction makes an oblique angle to the direction of the field B .
- (2007) Define the magnetic field intensity.
- (2007) A long solenoid has 10 turns per cm and carries a current of 2.0 A. Calculate the magnetic field intensity at its centre.
- (2007) An electron having 450 eV of energy enters at right angles to a uniform magnetic field of strength $1.50x10^{-3}$ T. Show that the path traced by the electron in a uniform magnetic field is circular and estimate its radius.
- (2007) A charged oil drop of mass $6.0x10^{-15}$ kg falls vertically in air with a steady velocity between two long parallel vertical plates 5.0 mm apart. When a potential difference of 3000 V is applied between the plates the drop falls with a steady velocity at an angle of 58° to the vertical.
  - Determine the charge Q , on the oil drop.
- (2007) A coil having 475 turns and cross sectional area $20cm^2$, rotates at $600r.p.m$. in a uniform magnetic field of 0.01 T. Find:
  - the peak e.m.f and the r.m.s. e.m.f induced in the coil.
  - show these values on a graph of E vs time.
- (2009) Outline four applications of eddy currents.
- (2010) Distinguish between magnetic flux density and magnetic induction.
- (2010) Describe using a sketch graph how magnetic flux density varies with the axis (both inside and at the ends) of a long solenoid carrying current.
- (2010) A solenoid 80 m long has a cross-sectional area of 16 cm^2 and a total of 3500 turns closely wound. If the coil is filled with air and carries a current of 3 A, Calculate:
  - Magnetic field density B at the middle of the coil.
  - Magnetic flux inside the coil.
  - Magnetic force H at the centre of the coil.
  - Magnetic induction at the end of the coil.

  - (v) Magnetic field intensity at the middle of the coil.

- (2013) Mention the factors which determine the magnitude and direction of the force experienced by a current-carrying conductor in a magnetic field.
- (2013) What is the maximum torque on a 400− turns circular coil of radius 0.75 cm that carrying a current of 1.6 mA and resides in a uniform magnetic field of 0.25 T?
- (2013) Brielfly explain how you can demonstrate that there are two types of charges in nature.
- (2013) A 10 eV proton is circulating in a plane at right angles to a uniform magnetic field of magnetic flux density of 1.0×10^{-4} Wb/m^2 Calculate the cyclotron frequency of a proton.
- (2013) A toroid of inner radius 25 cm and an outer radius of 28 cm has 4500 turns of wound around it which passes a Current of 12 A. What will be the induction of the magnetic flux;
  - Outside the toroid.
  - inside the core of the toroid,
  - in an empty space surrounding the toroid.
- (2016) What is meant by the following terms:
  - Phase of alternating e.m.f.
  - Root mean square (r.m.s.) value of alternating e.m.f.
- (2016) State the following laws or theorems as applied in magnetism.
  - Biot-Savart law
  - Amperes theorem
- (2016) Derive an expression for the magnetic flux density B at the centre of the circular coil of radius r and N turns placed in air carrying a current i.
- (2016) The diameter of a 40 turn circular coil is 16 cm and it has a current of 5 A. Calculate:
  - The magnetic induction at the centre of the coil
  - The magnetic moment of the coil.
  - The torque action on the coil if it is suspended in a uniform magnetic field of 0.76 T such that its plane is parallel to the field.
- (2017) Draw the diagram of the solenoid with certain number of tums placed in the magnetic field and indicate any suitable directions of the flow of current in it.
- (2017) Write down the formula for the magnetic field induced at the centre of solenoid.
- (2017) It is desired to design a solenoid that produces a magnetic field of 0.1 T at the centre. If the radius of solenoid is 5 cm, its length is 50 cm and carries a current of 10 A; Calculate:
  - The number of turns per unit length of the solenoid.
  - The total length of a wire required.
- (2017) State the Biot-Savart law.

- (2017) In a hydrogen atom, an electron keeps moving around its nucleus with a constant speed of 2.18×10^6 m/s. Assuming that the orbit is a circular of radius 5.3×10^{-11} m. determine the magnetic flux density produced at the site of the proton in the nucleus.
- (2018) A circular coil of 300 turns has a radius of 10 cm and carries a current of 7.5 A. Calculate the magnetic field at:
  - the centre of the coil.
  - a point which is at a distance of 5 cm from the centre of the coil.
- (2019) Identify four factors that affect the force experienced by a current-carrying conductor in a magnetic field.
- (2019) Write the mathematical expression which define magnetic flux density and use it to deduce its S.I. units.
  - Apply an expression obtained above to develop the formula for the force on a conductor carrying current i if the conductor and the magnetic fields are not at night angles.
- (2019) State the condition which makes the magnetic force on a moving charge in a magnetic field to be maximum.
- (2019) Use mathematical expression to justify the statement that there will be no change in the kinetic energy of a charged particle which enters a uniform magnetic field when its initial velocity is directed parallel to the field.