FACULTY OF INDUSTRIAL SCIENCES & TECHNOLOGY
MATERIAL TECHNOLOGY PROGRAMME

ELECTRICITY, MAGNETISM & OPTICS

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CH07: MAGNETIC FORCES AND FIELDS

1. A beam of protons moves at 3.0×10^5 m/s through a uniform 2.0 T magnetic field directed along the positive z-axis. The velocity the proton beam lies in the *xz*-plane and is directed at 30° to the +z-axis. Find the force on the proton beam.

2. A magnetic field exerts a force of 8.0×10^{-14} N towards the west on a proton moving vertically upward at a speed of 5.0×10^6 m/s. Determine the magnitude and direction of the magnetic field in this region.

3. A square loop of wire with side l = 5.0 cm is in a uniform magnetic field B = 0.16 T. Calculate the magnetic flux in the loop
   (i) when B is perpendicular to the face of the loop.
   (ii) when B is at an angle of 30° to the area A of the loop.

4. A straight horizontal copper rod carries a current of 50.0 A from west to east in a region between the poles of a large electromagnet. In this region, there is a horizontal magnetic field toward the northeast (that is, 45° north of east) with magnitude 1.20 T.
   (i) Find the magnitude **and** direction of the force on a 1.00 m section of rod.
   (ii) While keeping the rod horizontal, determine the orientation of the rod to maximize the magnitude of the force, and calculate the force in this case.

5. A long horizontal wire carries a current of 6.0 A in a direction 35° east of north, in a region with uniform 0.04 T magnetic field horizontally to the east. Determine the magnitude and direction of the force on each centimeter of wire.