(M1-3)Magnetic Field of a Circular Loop

Aim of experiment

Determination of magnetic field arises from a circular current loop along its axis.

Apparatus

Circular Loop – D.C Power Supply- Ammeter – Magnetic Probe.

Theory of experiment

Electric currents produce magnetic fields. For a current element, ids, the produced magnetic field, *dB* at a distance *r*, according to the *Biot-Savart law* is given by

$$dB=\mu_o ids/4\pi r^2 \qquad (1)$$

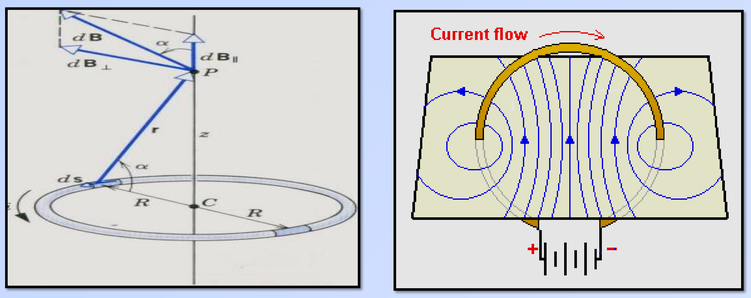

Figure 1. Shows a magnetic field pattern of circular loop of radius R carrying a current i.

At a point *P* on the axis a distance *z* from the center of the loop the integration of *Biot-Savart law* produced a magnetic field *B* given by

$$B = \mu_o iR^2/2(R^2 + z^2)^{3/2} \qquad (2)$$

The magnitude of the magnetic field on the axis of a circular current loop is given by Equation (2). The field has its largest value in the plane of the loop and de-creases as the distance *z* increases.

The direction of the field is determined by the *right-hand rule*: grasp the wire in the right hand, with the mag-netic field.
If a coil carrying current magnetic field is measured as a function of distance, z, this process is called magnetic mapping.

Procedure

1. Connect the circular loop with the D.C power supply and the ammeter.
2. Let current 1 A passing through the coil.
3. Put the magnetic probe at the center of the circular loop and record the corresponding magnetic field *B(z)*.
4. Move magnetic probe away from the center and on the axis of the circular loop each 0.5 cm up to 5cm and record the magnetic field.
5. Repeat the above steps two extra more times and tabulate your results.

Results

z (m)	$1/z^3$ (m^{-3})	B_1 (T)	B_2 (T)	B_3 (T)	B_{av} (T)