Experiment No: M3

Experiment Name: **"***Current Balance*"

Objective:

1. To observe the force acting on the current carrying wire in an uniform magnetic field.
2. Determine which parameters that the force depends on.

Keywords:

Lorentz force, magnetic field, magnetic force, drift velocity

Theoretical Information:

The magnetic force $\overrightarrow{F_B}$ acting on a particle with charge q moving with the $\overrightarrow{v_s}$ drift velocity in the uniform magnetic field is shown below,

$$\overrightarrow{F_B} = q\ \overrightarrow{v_s} \times \vec{B} \qquad (1)$$

$\vec{B}$ is the magnetic field acting on the particle. This force is called the Lorentz force. Considering the experiment system (Figure 5.1), magnetic force can be examined. If the volume of the wire is $A\ l$,where A area and l length, the total charge in the wire will be $n\ A\ l$. n is the number of charge per unit volume. Total magnetic force acting on the wire is given below,

$$\overrightarrow{F_B} = \left(q\ \overrightarrow{v_s} \times \vec{B}\right) nAl \qquad (2)$$

Remembering that current flowing through the wire is defined by $\vec{I} = nq\ \overrightarrow{v_s} A,$ so Eq. (2) can be modified as below,

$$\left|\overrightarrow{F_B}\right| = \left(q\ \left|\overrightarrow{v_s}\right|\ \left|\vec{B}\right| \sin\theta\right) nAl \qquad (3)$$

$$\left|\overrightarrow{F_B}\right| = I\ l \left|\vec{B}\right| \sin\theta \qquad (4)$$

$$\left|\overrightarrow{F_B}\right| = I\ l \times \vec{B} \qquad (5)$$

Before starting the experiment, take the magnetic force equation into consideration when deciding in which situations the wire will be affected by magnetic force.

The direction of the magnetic force on current carrying wire is defined by *right-hand rule*. As shown in Fig.1, four fingers on the right hand point the magnetic field direction and thumb points the direction of current flowing the wire. Direction the palm of the right hand shows us the direction of magnetic force on current carrying wire.

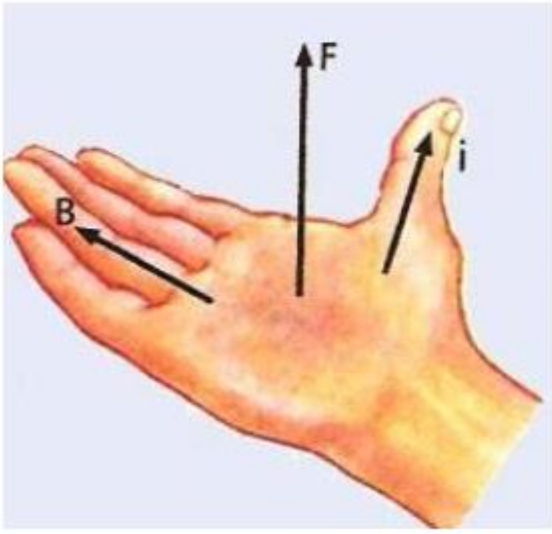

Figure 1 : Right-Hand Rule.