MAGNETIC EFFECT OF ELECTRIC CURRENT
Magnetic Flux

magnetic flux

Magnetic flux is a measurement of the total magnetic field which passes through a given area. It is a useful tool for helping describe the effects of the magnetic force on something occupying a given area. The measurement of magnetic flux is tied to the particular area chosen. We can choose to make the area any size we want and orient it in any way relative to the magnetic field.

Magnetic Flux Symbol

Magnetic flux is commonly denoted using the Greek letter Phi or Phi suffix B.

Magnetic flux symbol: Φ or Φ_B.

Magnetic Flux Formula

Magnetic flux formula is given by:

$$\phi_B = B.A = BA\cos\Theta$$

Where,

- Φ_B is the magnetic flux.
- B is the magnetic field
- A is the area
- θ the angle at which the field lines pass through the given surface area

Magnetic Flux Unit

Magnetic flux is usually measured with a **flux meter**. The SI and CGS unit of magnetic flux is given below:

The SI unit of magnetic flux is **Weber (Wb).**

The fundamental unit is **Volt-seconds.**

The CGS unit is **Maxwell.**

You may also want to check out these topics given below!

Magnetic Field And Magnetic Field Lines

Magnetic Field Due to Current Carrying Conductor

Understanding Magnetic Flux

Faraday's great insights lay on finding a simple mathematical relation to explain the series of experiments that he conducted on electromagnetic induction. Faraday made numerous contributions to science and is widely known as the greatest experimental scientist of the nineteenth century. Before we start appreciating his work, let us understand the concept of **magnetic flux** which plays a major part in electromagnetic induction.

In order to calculate the magnetic flux, we consider the field-line image of a magnet or the system of magnets, as shown in the image below. The magnetic flux through a plane of the area given by A that is placed in a uniform magnetic field of magnitude given by B is given as the scalar product of the magnetic field and the area A. Here, the angle at which the field lines pass through the given surface area is also important. If the field lines intersect the area at a glancing angle, that is,

- when the angle between the magnetic field vector and the area vector is nearly equal to 90^o, then the resulting flux is very low.
- When the angle is equal to 0^o, the resulting flux is maximum.

Mathematically,

$$\phi_B = B.A = BA\, cos\, \Theta$$

Where θ is the angle between vector A and vector B.

If the magnetic field is non-uniform and at different parts of the surface, the magnetic field is different in magnitude and direction, then the total magnetic flux through the given surface can be given as the summation of the product of all such area elements and their corresponding magnetic field.

Mathematically,

$$\phi_B = B_1.dA_1 + B_2.dA_2 + B_3.dA_3 + \ldots = \sum_{all} B_i.dA_i$$

It is clear from the equation given above that the magnetic flux is a scalar quantity. Its SI unit is given as **Weber** (Wb) or **tesla meter squared** (Tm^2).

Measurement of Magnetic Flux

The SI unit of magnetic flux is Weber (Wb) or tesla meter squared (Tm^2) named after German physicist Wilhelm Weber. Magnetic flux can be measured with a magnetometer. Suppose a probe of the magnetometer is moved around an area of 0.6 m^2 near a large sheet of magnetic material and indicates a constant reading of 5 mT. Then the magnetic flux through that area is calculated as (5×10^{-3} T) · (0.6 m^2) = 0.0030 Wb. In the event of changing magnetic field reading over an area, it would be necessary to find the average reading.

Magnetic Flux Density Unit:

The CGS and SI unit of magnetic flux density is given in the table below.

Unit of Magnetic Flux Density	
SI unit	Tesla (abbreviated as T)
CGS unit	Gauss (abbreviated as G or Gs)