MAGNETIC FLUX

Magnetic flux, is a measure of quantity of magnetism, taking account of the strength and the extent of a magnetic field. The flux through an element of area perpendicular to the direction of magnetic field is given by the product of the magnetic field density and the area element. More generally, magnetic flux is defined by a scalar product[[1]] of the magnetic field density and the area element vector. Gauss's law for magnetism, which is one of the four Maxwell's equations, states that the total magnetic flux through a closed surface is zero. This law is a consequence of the empirical observation that magnetic monopoles do not exist or are not measureable. The SI unit of magnetic flux is the weber, and the unit of magnetic flux density is the weber per square meter, or tesla.

In symbols, this means:

$$\Phi_m \equiv \iint \mathbf{B} \cdot d\mathbf{S}$$

where Φ_m is the magnetic flux and B is the magnetic flux density.

We know from Gauss's law for magnetism that

$$\nabla \cdot \mathbf{B} = 0.$$

This equation, in combination with the divergence theorem[[2]], provides the following result:

$$\oiint_{\partial V} \mathbf{B} \cdot d\mathbf{S} = \iiint_V \nabla \cdot \mathbf{B}\, d\tau = 0.$$

In other words, the magnetic flux through any closed surface must be zero; there are no free "magnetic charges".

By way of contrast, Gauss's law for electric fields, another of Maxwell's equations, is

$$\nabla \cdot \mathbf{E} = \frac{\rho}{\epsilon_0},$$

where E is the electric field intensity, ρ is the free electric charge density, (not including dipole charges bound in a material), and ϵ_0 is the permittivity of free space.

Note that this indicates the presence of electric monopoles, that is, free positive or negative charges.

The direction of the magnetic-flux-density vector $\mathbf{B}$ is by definition from the south to the north pole of a magnet (within the magnet). Outside of the magnet, the field lines will go from north to south.

A change of magnetic flux through a loop of conductive wire will cause an emf, and therefore an electric current, in the loop. The relationship is given by Faraday's law:

$$\mathcal{E} = \oint \mathbf{E} \cdot d\mathbf{s} = -\frac{d\Phi_m}{dt}.$$

and is the principle behind an electric generator.

Source : http://engineering.wikia.com/wiki/Magnetic_flux