

## 1 Magnetic fields:

### 1.1 Total flux equation:

$$\phi = BA \quad (\text{Wb})$$

## 2 Tesla

*The flux density of the field that exerts a force of 1N on a 1m long wire, placed at right angles to the field and carrying a current of 1A.*

$$F = BIl \quad (\text{T})$$

Where  $B$  is the component of the field that is **perpendicular** to the current,  $I$  the **current** (A) in the system and  $l$  the **length** (m).

## 3 Lorentz Force:

$$F = Bqv \quad (\text{N})$$

Where  $F$  is the force on a moving charge in a magnetic field,  $B$  is the **total flux** (Wb) in the magnetic field,  $q$  is the **charge** (C) of the moving particle and  $v$  its **velocity** ( $\text{m s}^{-1}$ ).

## 4 The Laws of Electromagnetic Induction:

### 4.1 Faraday's Law

*An e.m.f. is induced in a conductor whenever the magnetic flux taht links with that conductor changes.  
The size of the e.m.f. is equal to the rate of change of the flux linkage.*

### 4.2 Lenz's Law

*The direction of the induced e.m.f./current is always such as to oppose the change causing it.*

### 4.3 Equation:

$$E = \frac{\Delta N\phi}{\Delta t} \quad (\text{V})$$

Where  $E$  is the **induced e.m.f.** (V), the product  $N\phi$  is the **flux linkage** (Wb),  $N$  is the number of turns of the coil and  $\phi$  is the **magnetic flux** (Wb).

### 4.4 Conductor Cutting Lines of Flux:

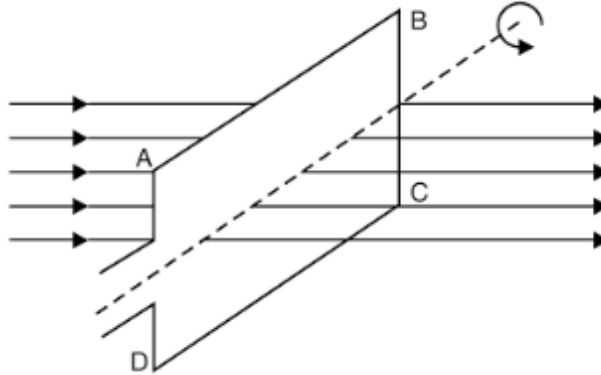
$$E = Blv \quad (\text{V})$$

Where  $E$  is the induced e.m.f.  $l$  is the length of the conductor cutting the field and  $v$  is the speed at which the conductor cuts the field.

## 5 A.C. Generation:

### 5.1 Rotating rectangular coil:

#### 5.1.1 Diagram :



perpendicular  $\Rightarrow$  peak e.m.f.

parallel  $\Rightarrow$  no e.m.f.

#### 5.1.2 Induced e.m.f. formula:

$$E = 2\pi f \cdot BAN \cdot \sin(2\pi ft) \quad (\text{V})$$

#### 5.1.3 Peak induced e.m.f formula:

$$E_0 = 2\pi f BAN \quad (\text{V})$$

## 6 R.M.S. value of an A.C. current:

$$I_{RMS} = \frac{I_0}{\sqrt{290}} \quad (1)$$