

$$H \cdot dl = NI \quad (1)$$

where

$$dl = l_c$$

$$B = \mu_0 \mu_r H \quad (2)$$

where  $\mu_0 = 4\pi \times 10^{-7}$  and  $\mu_r = 1.05$  for air.  
For steel,  $\mu_r$  is in the range of 2000 to 6000.

$$\frac{B}{\mu_0 \mu_r} = H \quad (3)$$

$$\frac{B}{\mu_0 \mu_r} \cdot l_c = NI \quad (4)$$

$$B = \frac{\Phi}{A_c} \quad (5)$$

$$\frac{\Phi}{\mu_0 \mu_r A_c} \cdot l_c = NI \quad (6)$$

where

$$\frac{l_c}{\mu_0 \mu_r A_c} = R_{\text{rel}}$$

$$\Phi R_{\text{rel}} = NI \quad (7)$$

$$NI = \Phi R_{\text{rel}}$$

where

$NI$  = Magnetomotive Force (MMF),

$\Phi$  = Flux,

$R_{\text{rel}}$  = Reluctance of the Magnetic Circuit.