Q1:- Two magnetic S poles are located 5cm apart in air. If each pole has a strength of 1m wb, find the force of repulsion between them.

Soln:-

We know that:-

$F \propto \frac{m_1 m_2}{d^2}$

$F = \frac{K m_1 m_2}{d^2}$

$F = \frac{m_1 m_2}{4\pi \mu_o \mu_r d^2}$ $\left\{K = \frac{1}{4\pi \mu_o \mu_r}\right\}$

$F = \frac{m_1 m_2}{4\pi \mu_o \mu_r d^2}$

Putting values:-

- Here $m_1 = m_2 = 5\,m\,wb = 5\times10^{-3}\,wb$

$d = 5\,cm = 0.05\,m$

$\mu_o = 4\pi\times10^{-7}\,H/m$

$\mu_r = 1$ (for air)

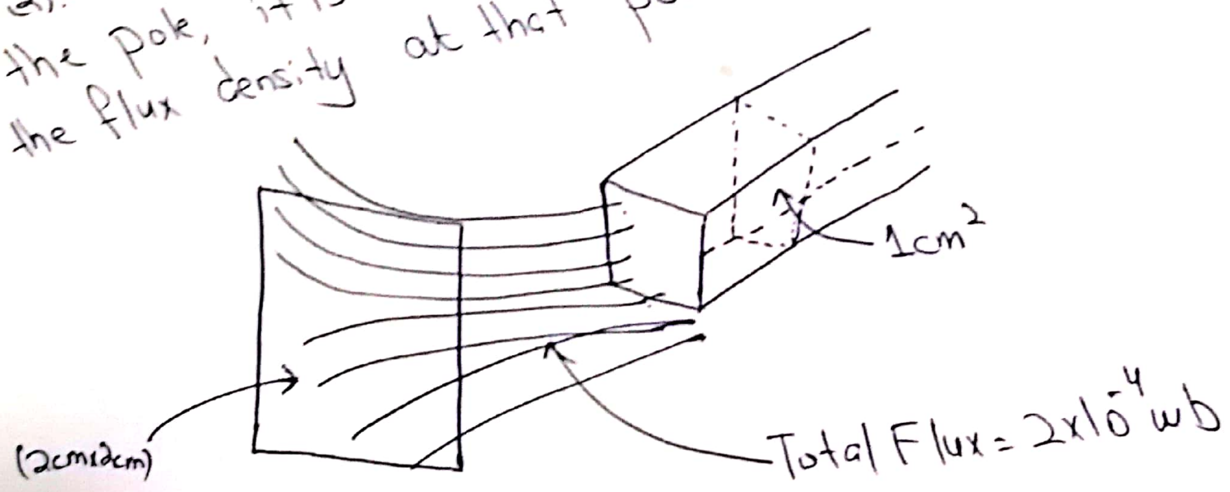
$$F = \frac{(5\times10^{-3})(5\times10^{-3})}{4(3.14)(4\times3.14\times10^{-7})(1)(0.05)^2}$$

$\boxed{F = 633\,N}$ Ans:-

Q2:- The total flux emitted from the pole of a bar magnet is $2\times10^{-4}$ wb (as shown in fig. below):-

(i):- If the magnet has a cross-sectional area of $1\,cm^2$, determine the flux density within the magnet.

(2):- If the flux spreads out so that a certain distance from the pole, it is distributed over an area of 2cm by 2cm, find the flux density at that point.



i):- <u>Flux density within magnet:-</u>

$\phi = 2\times10^{-4}$ wb , $A = 1cm^2 = 1\times10^{-4} m^2$

Flux density, $B = \frac{\phi}{A} = \frac{2\times10^{-4}}{1\times10^{-4}} = \boxed{2 wb/m^2}$

2):- <u>Flux density away from the pole:-</u>

$\phi = 2\times10^{-4}$ wb , $A = 2\times2 = 4cm^2 = 4\times10^{-4} m^2$

Flux density, $B = \frac{\phi}{A} = \frac{2\times10^{-4}}{4\times10^{-4}} = \boxed{0.5 wb/m^2}$

Q3:- Flux density in the air gap between N and S poles is 2.5 wb/m². The poles are circular with a diameter of 5.6cm. Calculate the total flux crossing the air gap.

Soln:-

$B = 2.5 wb/m^2$, $d = 5.6cm$

Area of each pole, $A = \pi r^2 = 3.14\left(\frac{d}{2}\right)^2 = 3.14\left(\frac{5.6}{2}\right)^2$

$A = 24.63 cm^2$

$A = 24.63\times10^{-4} m^2$

∴ Flux crossing the air gap is given by:-

$\phi = B\times A$

$= (2.5)(24.63\times10^{-4})$

$\phi = 6.16\times10^{-3}$ wb

$\boxed{\phi = 6.16 mWb}$ Ans:-

Q4:- A coil has a magnetic path length of 33cm and a magnetic field strength of 650 AT/m. The coil current is 250mA. Determine the number of turns of the coil.

Soln:- $L = 33\,cm = 0.33\,m$

$H = 650\,AT/m$

$I = 250\,mA = 0.25\,A$

$N = ?$

We know that

magnetic Field Strength $(H) = \frac{NI}{L}$

$$N = \frac{H \times L}{I}$$

Putting values

$$N = \frac{650 \times 0.33}{0.25} = \boxed{858 \text{ Turns}}$$ Ans:-

Q5:- Determine the mmF required to generate a total flux of 100μwb in an air gap 0.2cm long. The cross sectional area of the air gap is 25cm².

Soln:- $\phi = 100\,\mu wb = 100 \times 10^{-6}\,wb$

$L = 0.2\,cm = 0.2 \times 10^{-2}\,m$

$A = 25\,cm^2 = 25 \times 10^{-4}\,m^2$

Flux density, $B = \frac{\phi}{A} = \frac{100 \times 10^{-6}}{25 \times 10^{-4}} = 4 \times 10^{-2}\,wb/m^2$

(As $B = \mu_0 \mu_r H$)

magnetic field strength, $H = \frac{B}{\mu_0 \mu_r}$

$$H = \frac{4\times10^{-2}}{(4\pi\times10^{-7})(1)}$$ (For air; $\mu_r = 1$)

$H = 3.18\times10^{4}$ AT/m

Now, $H = \frac{mmF}{L}$

or $mmF = H * L = (3.18\times10^{4})(0.2\times10^{-2})$

$mmF = 63.7$ AT. Ans:-