6.7.21

CH-4 Home Assignment

1) Ampere's circutal law states that the line integral of magnetic field $\vec{B}$ around any closed part in vaccum is μ_0 times the total current through the closed path.

Let n be the no. of turns per unit length.
Total no. of ~~th~~ ~~term~~ turns = nh
Enclosed current is $I_e - I(nh)$

From Ampere's circuital law

$B l = \mu_0 I_e$ $\quad B_h = \mu_0 I(nh)$

$B = \mu_0 h I$

2) a) $\oint \vec{B} \cdot d\vec{l} = \mu \times 0$

$$\oint_{pqrs} \vec{B} \cdot d\vec{l} = \int_{po} \vec{B} \cdot d\vec{l} + \int_{qr} \vec{B} \cdot d\vec{l} + \int_{rs} \vec{B} \cdot d\vec{l} + \int_{sp} \vec{B} \cdot d\vec{l}$$

$$\int_{qr} \vec{B}\cdot d\vec{l} = \int_{sp} \vec{B}\cdot d\vec{l} = \int B\,dl\cos 90 = 0$$

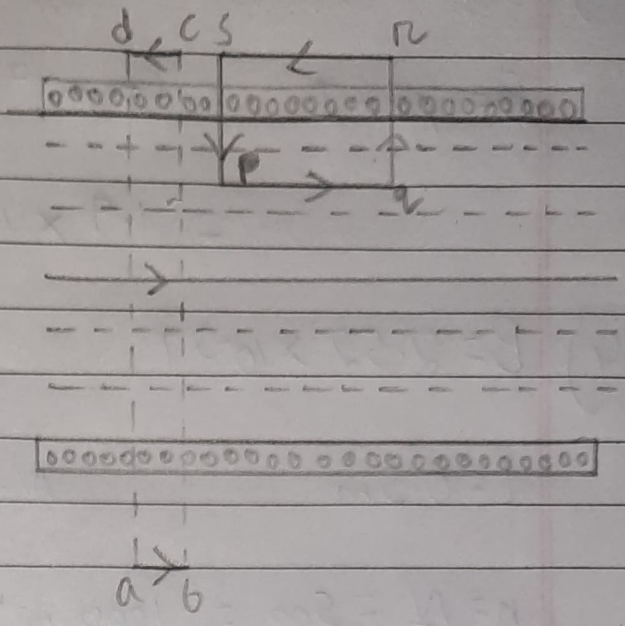
$$\int_{rs} \vec{B}\cdot d\vec{l} = 0$$

$$\oint_{PQRS} \vec{B}\cdot d\vec{l} = \int_{PQ} \vec{B}\cdot d\vec{l} = BL$$

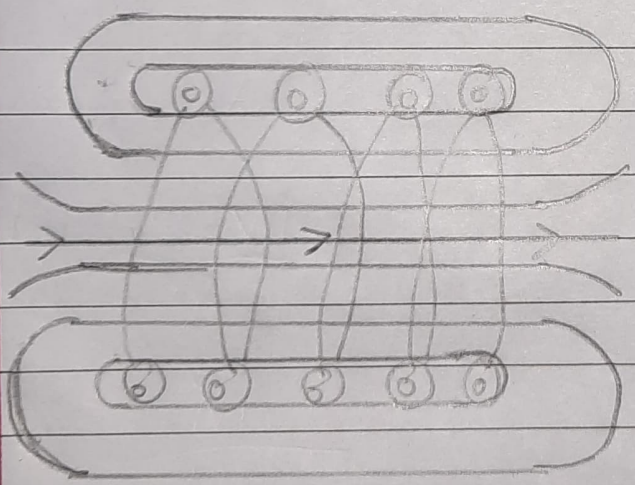
$$\oint \vec{B}\cdot d\vec{l} = \mu_0 I$$

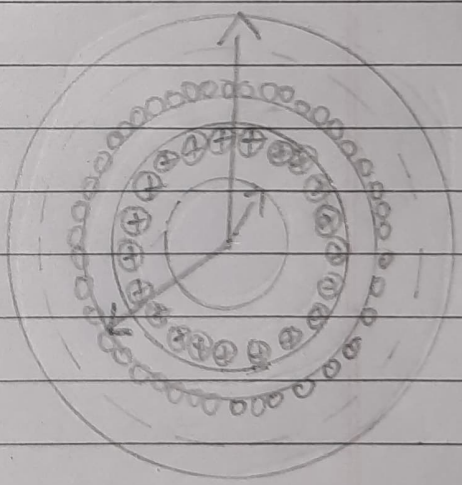
$$BL = \mu_0 (\mu_0 n l I)$$

$$B = \mu_0 n I$$



b) Magnetic lines do not exist outside the body of a toroid. Toroid is a closed & solenoid is open on both side. Magnetic field is uniform inside a toroid whereas, for a solenoid, it is different at 2 ends & centre.





c) The magnetic field is made strong by

i) Passing large current &

ii) Using luminated coil of soft iron.

3) $n = 300$ $\quad i = 5A$ $\quad l = 0.5m$ $\quad r = 10^{-2} m$

$B = \mu_0 n I = 4\pi \times 10^{-7} \times 300 \times 5$

$= 1.9 \times 10^{-3} T$

4) $B = 2.52 \times 10^{-3} T$

$l = 0.5m$ $\quad N = 500$

$n = \frac{N}{l} = \frac{500}{0.5} = 1000 \, m^{-1}$

$B = \mu_0 n i$

$\Rightarrow i = \frac{B}{\mu_0 n} = \frac{2.52 \times 10^{-3}}{4\pi \times 10^{-7} \times 1000} = 2.0 A$