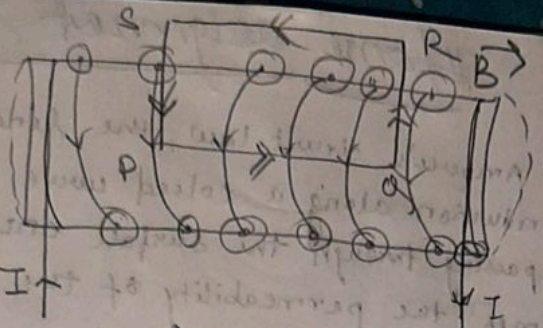
Home assignment

1.) According to the Ampere's circuit law, the line integral of magnetic field induction along a colsed curve is equal to the total current passing through the surface enclosed in the closed curve times the permeability of the medium.

$$\oint \vec{B} \cdot \vec{dl} = \mu_0 I_{enclosed}.$$

(2) (a)



$$\int \vec{B}\cdot d\vec{l} = \int_{PQ} \vec{B}\cdot d\vec{l} + \int_{QR} \vec{B}\cdot d\vec{l} + \int_{RS} \vec{B}\cdot d\vec{l} + \int_{SP} \vec{B}\cdot d\vec{l}$$

$$= \int B\cdot dl \cos 0^\circ + \int B\cdot dl \cdot \cos 90^\circ + \int B\cdot dl \cos 0 + \int B\cdot dl \cos 90^\circ$$

$$= B\cdot L + 0 + BL + 0$$

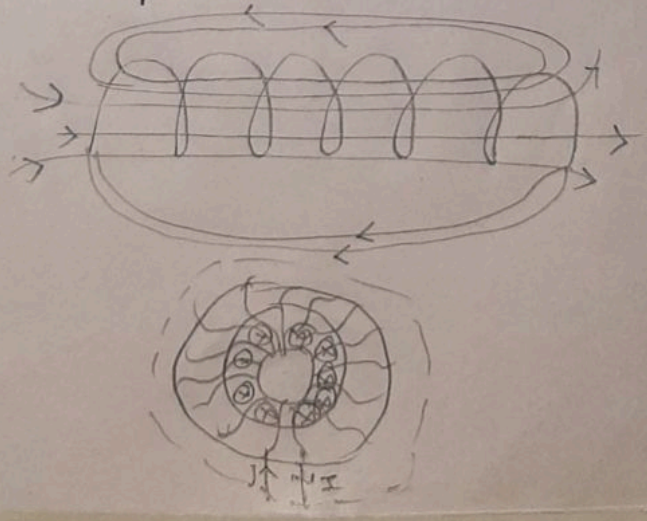
→ Third term is 0 as the magnetic field outside solenoid = 0.

From Ampere's Circuit law =

$$BL = \mu_0 (nLI)$$

$$B = \mu_0 nI$$

(b) A toroid is a solenoid bent into the form of a closed ring. The magnetic field lines of solenoid are straight line parallel to the axis inside the solenoid.



(c) The magnetic field can be increased by :-

→ Increasing the no. of turns per unit length of the solenoid.

→ Using a laminated iron core inside a soleroid.

→ By increasing the current magnitude.

3.) $n = 300$ turns/m

$I = 5\ A$

$B = \mu_0 n I$

$= 4\pi \times 10^{-7} \times 300 \times 5$

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

4.) $\dot{n} = \frac{N}{l} = \frac{500}{0.5} =$ 1000 turns/m

As $B = \mu_0 \dot{n} I$

$I = \frac{B}{\mu_0 n} = \frac{2.52 \times 10^{-3}}{4\pi \times 10^{-7} \times 1000} = 2.A$