Aneesh Panchal
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EXPERIMENT - 8

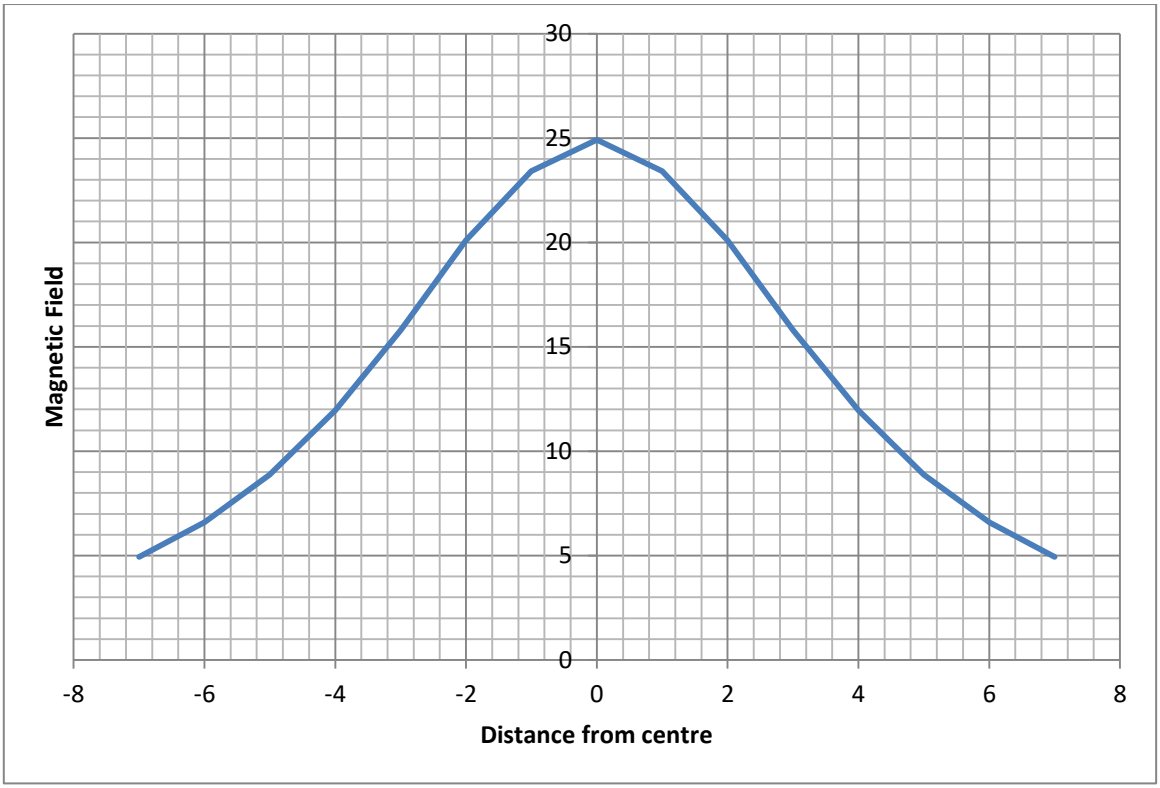
AIM:

To study the variation of magnetic field of current carrying circular coil along its axis and estimate the radius of the coil by plotting a graph between magnitude of B_{axis} and distance from the centre.

Observations:

Variation of Magnetic Field with distance from centre (x),
No. of turns, n = 20
Current, I = 1 A
Radius, r_o = 5 cm = 0.05 m

S.no.	Distance from centre x (cm)	Deflection when current is				Mean, θ	$\tan\theta$	B_x $(X10^{-5})$	$B_o = \frac{B_x}{\tan\theta}$ $(X10^{-5})$
		Direct		Reversed					
		θ_1	θ_2	θ_3	θ_4				
01.	-5.0	69	68	68	69	68.5	2.53865	8.885	3.49989167
02.	-3.0	77	78	77	78	77.5	4.51070	15.788	3.50012193
03.	-1.0	81	82	81	82	81.5	6.69115	23.419	3.49999626
04.	0.0	82	82	81	83	82	7.11537	24.91	3.50087206
05.	1.0	81	83	80	82	81.5	6.69115	23.419	3.49999626
06.	3.0	77	78	78	77	77.5	4.51070	15.788	3.50012193
07.	5.0	68	68	69	69	68.5	2.53865	8.885	3.49989167
08.	7.0	54	55	55	54	54.5	1.41020	4.936	3.50021274



Calculations:

Graph changes its nature at around $y = 9\ X10^{-5}\ T$

Distance between points corresponding to this magnitude of Magnetic Field,

$d = 9.9\ cm\ (approx)$

Radius of coil,

$r = \frac{d}{2} = 4.95\ cm\ (approx)$

Error Percentage,

$\%e = \frac{|r - r_o|}{r_o} X\ 100 = \frac{|4.95 - 5|}{5} X\ 100 = 1\%$

Results:

The calculated radius of coil is $4.95\ cm\ (approx)$ with 1% error.

Discussions:

Total magnetic field at a point 'x' distance away from the axis of a circular coil of 'n' turns with radius 'r' is given by

$$B_x = \frac{\mu_o ni}{2} \frac{r^2}{(r^2 + x^2)^{\frac{3}{2}}}$$

Magnetic field produced in a current carrying coil is maximum at the centre.

Direction of magnetic field is same throughout the region on the axis of the coil.