Experiment No. 3
Tangent Galvanometer and Earth's Magnetic field

Aim :

(i) To determine reduction factor of a tangent galvanometer.

(ii) To determine the horizontal component of Earth's magnetic field.

~~**Apparatus :**~~

formula used :

$$\tan\theta = \frac{B_{coil}}{B_H}$$

$$B_{coil} = \frac{\mu_0 n I}{2a}$$

$$\Rightarrow B_H \tan\theta = \frac{\mu_0 n I}{2a}$$

$$\text{Reduction factor, } K = \frac{I}{\tan\theta}$$

$$\Rightarrow B_H = \frac{\mu_0 n K}{2a}$$

Experiment 1

Radius of coil = 5cm
Number of turns = 10

Radius of coil	Number of turns	Ammeter readings	Pointers deflection in degrees				Means	tano	$K = \frac{1}{\tan\theta}$	Average 'K'	B_H
(cm)		I(A)	Direct		Reverse		(degree)	(degree)	(A)	(A)	(T)
			θ_1	θ_2	θ_3	θ_4					
5	10	0.1	20	20	20	20	20	0.363 ~~2.234~~	0.278	~~1.712~~	3.479×10^{-5}
		0.2	36	36	36	36	36	0.726 ~~7.75~~	0.272		
		0.25	42	42	42	42	42	0.9 ~~2.291~~	0.277	0.28	
		0.5	61	61	61	61	61	1.804 ~~3.743~~	0.288		
		1	75	75	75	75	75	3.732	0.290		

Experiment 2

Radius of coil = 5cm
Current through the coil = 0.25A

Radius of coil (cm)	Ammeter readings I(A)	Number of turns	pointers deflection in degrees				Mean θ (degree)	tan θ (degree)	$K = \frac{1}{\tan\theta}$ (T)	B_H (T) $(\times 10^{-5})$
			Direct		Reverse					
			θ_1	θ_2	θ_3	θ_4				
5	0.25	10	42	42	42	42	42	0.9	~~0.28~~	3.48
		15	54	54	54	54	54	1.376	0.18	3.48
		20	61	61	61	61	61	1.804	0.14	3.48
		25	66	66	66	66	66	2.246	0.11	3.48
		35	72	72	72	72	72	3.077	0.08	3.48
		45	76	76	76	76	76	4.010	0.06	3.48

Calculations:

Experiment 1

$$K(\text{from graph}) = \frac{I}{\tan\theta} = \frac{0.25}{0.9} = 0.277\ A \simeq 0.28\ A$$

now, $$B_H = \frac{\mu_0 n K}{2a} = \frac{4\pi \times 10^{-7}}{2} \times \frac{10^2}{5 \times 10^{-2}} \times 0.277\ T$$

$$= 4 \times 0.277 \times 10^{-5} \times \pi$$

~~$= 1.108 \times 10^{-5}\ T$~~

$$= 3.479 \times 10^{-5}\ T$$

Experiment 2,

$$\text{Avg } B_H = \frac{(3.48 \times 10^{-5})\,6}{6} = 3.48 \times 10^{-5}\ T$$

$$\text{Slope} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{0.277 - 0.062}{0.1 - 0.02} = 2.687$$

$$= 2.7\ A$$

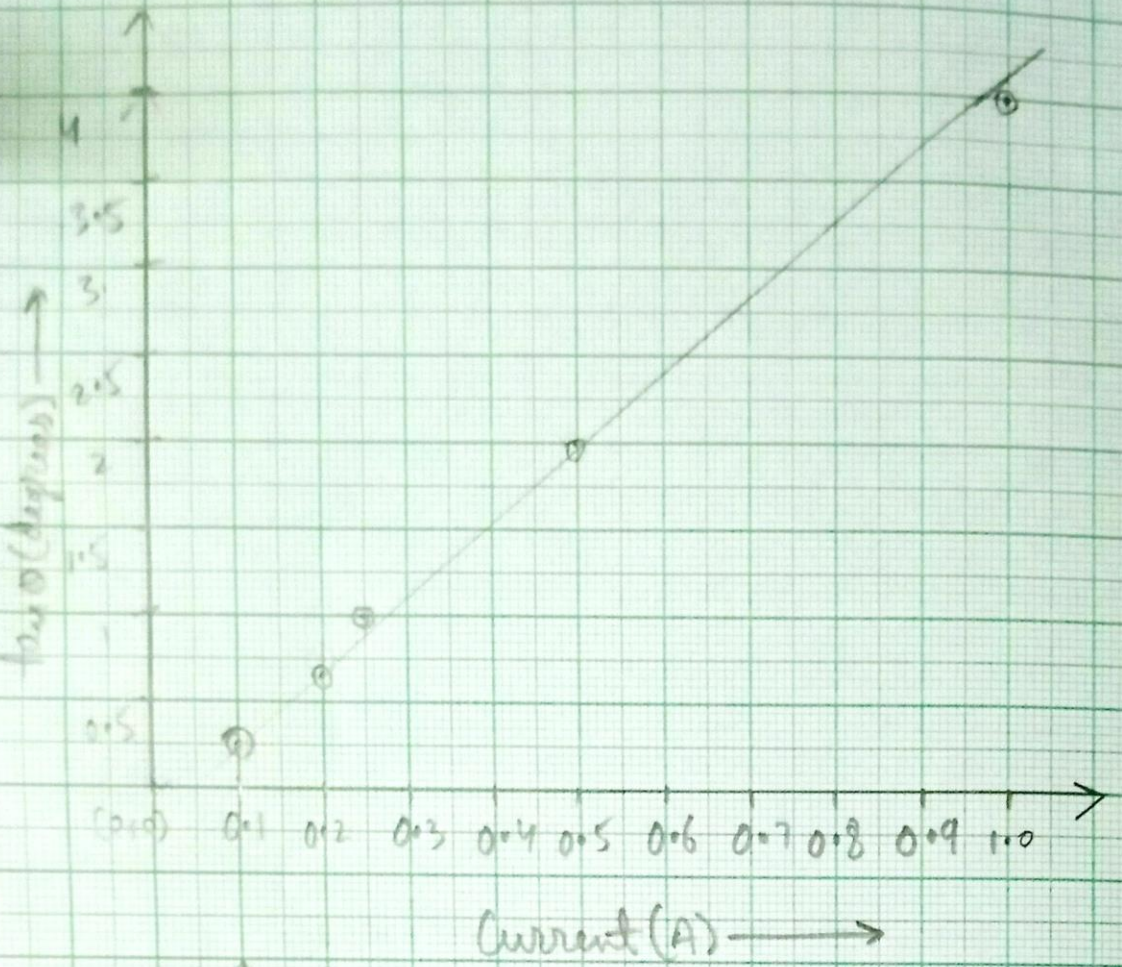
Conclusion

Reduction factor (K) = 0.28 A

Horizontal component of Earth's magnetic field =

$$3.479 \times 10^{-5}\ T$$

graph 1



graph 2