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EXPERIMENT NO. 12

NAME OF EXPERIMENT: TO DETERMINE THE VALUE OF DIP IN THE LABORATORY USING A DIP CIRCLE

APPARATUS REQUIRED

1. Dip circle
2. A spirit level

THEORY

- a) Bringing the Dip circle in the magnetic meridian

The dip at a place may be defined as the angle between the direction of the total intensity of the earth's magnetic field and horizontal component at that place.

- b) Without bringing the Dip-circle in the magnetic meridian.

If δ_1 and δ_2 be the value of apparent Dip at a place in any two positions of two vertical planes at right angles to each other. The value of true dip δ at the place is given by,

$$\cot^2 \delta = \cot^2 \delta_1 + \cot^2 \delta_2$$

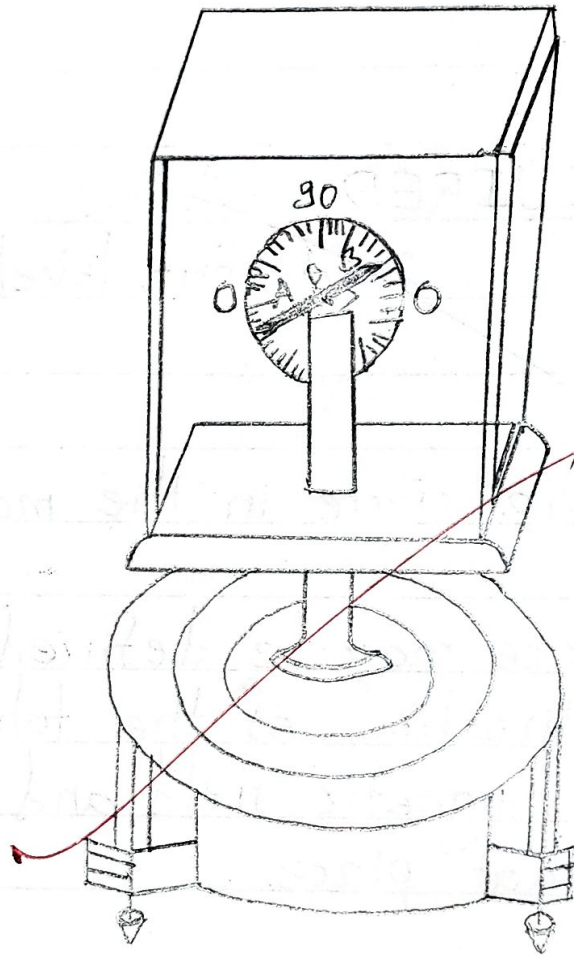


Fig. Dip Circle

PROCEDURE

1. The dip circle was levelled properly with the help of the levelling screw and the spirit level.
2. The box was rotated about a vertical axis till and magnetic field becomes vertical and pointed along the $90^\circ-90^\circ$ line. The index mark was brought to zero position by rotating the horizontal circular scale at the base.
3. From that position, the box was rotated further through 90° about the vertical axis over the horizontal scale to bring the needle in the magnetic meridian. The reading of upper end and lower end was noted.
4. The box was turned through 270° and again the value of upper end and lower end was noted.
5. The box was rotated through 90° over the horizontal scale. i.e. it was kept at $90^\circ + \theta$, $180^\circ + \theta$ and $270^\circ + \theta$ and value of upper end and lower end was noted.
6. The needle was remagnetised, operation was repeated and mean the value of δ_1 and δ_2 .

OBSERVATION

Bringing the dip circle in the magnetic meridian.

Position at which box is filled.	Position of needle	Needle reading		Mean δ	
		Upper end	Lower end		
90°	Front reversed	68°	72°	66.25°	
270°	Front reversed	64°	60°		

Needle Remagnetised

90°	Front reversed	64°	60°	66.25°	
270°	Front reversed	68°	72°		

Without bringing the dip circle in the magnetic meridian

	Position at which needle is fitted	Position of the needle	Needle Readings		Mean δ_1	Mean δ_2
			Upper end	Lower end		
1.	$\theta = 20^\circ$	Front reversed	82°	80°	76.5°	
	$\theta + 180^\circ = 200^\circ$	"	70°	74°		
	$\theta + 90^\circ = 110^\circ$		68°	73°		66.75°
	$\theta + 270^\circ = 290^\circ$		64°	62°		
2.	$\theta = 30^\circ$		79°	82°	75.75°	
	$\theta + 180^\circ = 210^\circ$		72°	70°		
	$\theta + 90^\circ = 120^\circ$		79°	81°		75.75°
	$\theta + 270^\circ = 300^\circ$		73°	70°		

CALCULATION

$$\cot^2 \delta = \cot^2 \delta_1 + \cot^2 \delta_2$$

$$\text{or, } \frac{1}{\tan^2 \delta} = \frac{1}{\tan^2 \delta_1} + \frac{1}{\tan^2 \delta_2}$$

$$\text{or, } \frac{1}{\tan^2 \delta} = \frac{\tan^2 \delta_2 + \tan^2 \delta_1}{\tan^2 \delta_1 \cdot \tan^2 \delta_2}$$

$$\text{or, } \tan^2 \delta = \frac{\tan^2 \delta_1 \cdot \tan^2 \delta_2}{\tan^2 \delta_1 + \tan^2 \delta_2}$$

$$\text{or, } \delta = \tan^{-1} \left(\sqrt{\frac{\tan^2 \delta_1 \cdot \tan^2 \delta_2}{\tan^2 \delta_1 + \tan^2 \delta_2}} \right)$$

(where, $\delta_1 = 76.5^\circ$; $\delta_2 = 66.75^\circ$)

$$\therefore \delta_{20} = \tan^{-1} \left(\sqrt{\frac{\tan(76.5)^\circ \cdot \tan(66.75)^\circ}{\tan(76.5)^\circ + \tan(66.75)^\circ}} \right)$$

$$\text{or, } \delta_{20} = \tan^{-1}(2.026)$$

$$\text{or, } \delta_{20} = 63.72^\circ$$

Again,

$$(\delta_1 = 75.75^\circ; \delta_2 = 75.75^\circ)$$

$$\therefore \delta_{30} = \tan^{-1} \left(\sqrt{\frac{\tan(75.75)^\circ \cdot \tan(75.75)^\circ}{\tan(75.75)^\circ + \tan(75.75)^\circ}} \right)$$

$$\text{or, } \delta_{30} = \tan^{-1}(2.73)$$

$$\text{or, } \delta_{30} = 69.88^\circ$$

$$\begin{aligned} \therefore \text{Mean } (\delta) &= \frac{\delta_{20} + \delta_{30}}{2} \\ &= \frac{63.72^\circ + 69.88^\circ}{2} \\ &= 66.8^\circ \end{aligned}$$

RESULT

Hence, the dip value in the laboratory was 66.8° .

PRECAUTIONS

1. The instrument must be properly leveled to make; (a) the base horizontal; (b) the plane of rotation of needle vertical; (c) to avoid any obstruction in needle during its rotation.
2. All magnets and magnetic substance should be removed from the working table.

