EXPERIMENT NO. 01

DATE :..... BRANCH :..... SECTION :.....

NAME :..... REGD. NO. :.....

GRADE :..... COMPLETE :.....

Sign. of Sr. Lect./Lecturer.

AIM OF THE EXPERIMENT :

To find the Cross–Sectional Area of a Wire Using a Screw Gauge :

OBJECTIVES OF THE EXPERIMENT :

On completion of this experiment, the students will be able to :

a. Measure least count by using principle of micrometer screw.

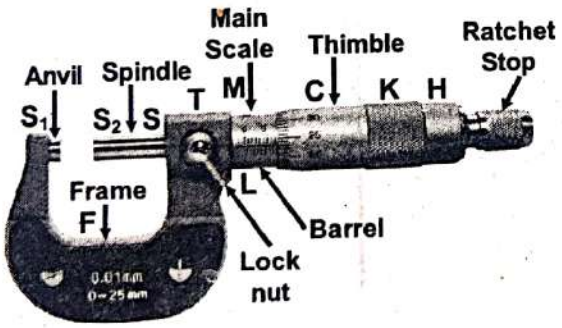
b. To measure the diameter of a given wire and its volume.

c. Calculate the Area of cross section of the given wire.

Apparatus/Equipment Required :

a.	Screw Gauge	b.	A Piece of Wire	c.	Geometry Box

EXPERIMENT FIGURE :



SCREW GAUGE

S : CUT SCREW
S_1 and S_2 : JAWS TO HOLD OBJECT
F : CURVED FRAME
M : MAIN SCALE
T : STEAM
K : SLEEVE
C : CIRCULAR SCALE
H : MILLED HEAD

THEORY :

Screw gauge is an instrument used for measuring accurately the diameter of a thin wire or the thickness of the sheet metal.

- It consists of U shaped frame having one fixed end and the other moveable cylinder marked with a horizontal line over which a fixed scale is marked called main scale.
- A cap is fitted over cylinder carries a moveable scale with 100 divisions around it, called scale.
- The cross–sectional area of a given piece of wire is given by = $\pi D^2 / 4$, where

D = diameter of the given wire.

Diameter of the wire, D = Pitch scale reading + Circular Scale Reading

Pitch Scale Reading = Pitch × number of complete rotations = (P × N)

Circular Scale Reading = (Difference between I and F) × Least Count = (I ~ F) × L.C.

∴ Diameter, D = {(P × N) + (I ~ F) × L.C.}, where I ~ F = I ~ F, if I> F or (I + 100) ~ F, if I < F

In case, while rotating the circular scale to find 'F' if graduation goes on decreasing.

PITCH :

Pitch is the distance covered by circular scale on linear scale by one complete rotation. (Dista between two consecutive threads of the screw)

$$\text{Pitch} = \frac{\text{Distance moved by the screw head in 10 complete rotations}}{10} \text{ cm}$$

Least Count = Pitch / Total No. of division in the circular Scale

WORKING FORMULA :

Diameter of the wire = Pitch scale Reading + Circular Scale Reading

= Pitch × Number of Complete Rotation + Least Count × (I ~ F)

CALCULATION OF LEAST COUNT (L.C.) :

Least count is the value of the smallest division of the screw i.e., the value of one division on circular scale.

∴ Least Count = Pitch (P) / No. of divisions on the circular scale (n)

i. **10 divisions** of the linear scale **= 1 Cm**

1 divisions of the linear scale = 1 / 10 = 0.1 cm.

10 complete rotations = 10 linear scale divisions.

1 complete rotation = 10 / 10 = 1 L.S.D. = 0.1 cm.

∴ Pitch (P) = 0.1 cm

∴ Least count (L.C.) = Pitch (P) / n = 0.1 / 100 = 0.001 cm.

or **20 L.S.D. = 1 Cm**

1 Linear Scale divisions (L.S.D.) = 1/20 = 0.5 cm

10 complete rotations = 10 LSD

1 complete rotation = LSD = 0.05 cm

Pitch (P) = 0.05

∴ L.C. = Pitch (P) / n = 0.05 / 100 **= 0.0005 cm.**

PROCEDURE :

a. **Standardize** linear scale with ordinary scale.

b. **Then,** Calculate Pitch (P) and Least Count (L.C.) of the given instrument.

c. **Determine** Initial Circular Scale Reading (I.C.S.R) or (I) when the wire is between the two stu Ensure it with clicking sound of milled head.

d. i. **Remove** the wire

ii. **Calculate** the number of complete rotations (N)

iii. **Note** final circular scale coincidence (F) when the two ends are closed.

e. **Find** I ~ F

i. For I ≥ F, difference = (I – F)

ii. For I < F, difference = (N + I) – F

Where **'N'** is the number of division on the circular scale.

f. **Find**
   i. Pitch Scale Reading by (Pitch × N) = X
   ii. Circular Scale Reading by L.C. × [I ~ F] = Y
   iii. Diameter of wire. = X + Y

g. **Repeat 'c' to 'f'** ten times at different position of the wire and then find out the mean value of diameter and calculate the cross–sectional area of the given wire using formula given.

OBSERVATION TABLE :

TABULATION FOR MEASURING DIAMETER OF THE WIRE

No of Obs.	Pitch. in cm	L.C. in cm	ICSR (I)	No. of Complete Rotation (N)	FCSR (F)	Extra Division (I ~ F)	P.S.R. in cm (Pitch × N) (X)	C.S.R. in cm L.C. × (I ~ F) (Y)	Diameter PSR + CSR in cm (X + Y)	Mean Diameter in cm
01										
02										
03										
04										
05										
06										
07										
08										
09										
10										

CALCULATION :

From the above table, the diameter of given wire D = ... cm

Hence, Cross–sectional Area of given piece of Wire is given by $\pi D^2 / 4$

$= (\pi / 4) \times \{\text{Diameter (D)}\}^2 = \cdots\cdots \text{cm}^2$

CONCLUSION :

SAFETY AND PRECAUTIONS :

a. While closing the gap, the screw head should not be turned till it is made tight rather turning of the screw head should be stopped when S_2 touches S_1.
b. Zero correction must be used and screw should not press hard.
c. While measuring, care should be taken such that no portion of the object under measurement touches the 'U – shaped' frame of the instrument.
d. The screw should always be turned in the same direction.

ASIGNMENT QUESTIONS

1. Why the instrument is named as Screw Gauge ?
2. What is the Pitch of the Screw gauge and least count of Screw gauge ?
3. How can you determine the number of complete rotation ?
4. Can you measure the radius of the wire by screw gauge ? If not. Why ?
5. What unit of measurement is used for cross sectional area of wire ?
6. How do you find the cross sectional area of a wire ?
7. What is the difference between surface and cross sectional area ?
8. What is the least count of screw, if the head scale of a screw gauge contains 100 divisions and pitch is 1 mm. ?
9. What is screw gauge commonly refered to as ?
10. How to calculate the zero error and zero correction of a screw gauge ?

WRITTING SPACE FOR ASSIGNMENT

EXPERIMENT NO. 02

DATE :..... BRANCH :..... SECTION :.....

NAME :..... REGD. NO. :.....

GRADE :..... COMPLETE :.....

Sign. of Sr. Lect./Lecturer.

AIM OF THE EXPERIMENT :

To find the thickness and volume of a Glass Piece using a Screw Gauge.

OBJECTIVES OF THE EXPERIMENT :

On completion of this experiment, the students will able to :

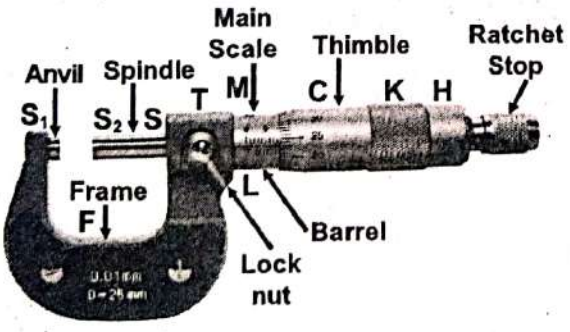
a. To measure the thickness of a given glass piece and its volume.
b. How to calculate the volume of a glass piece by measuring its thickness.
c. How to calculate zero error and zero correction of a screw gauge.

SETUP OF EXPERIMENT :

Equipment / Materials Required :

SL. NO.	NAME OF THE EQUIPMENT / MATERIAL	RANGE / SPECIFICATION	QUANTITY
1.	Screw Gauge		1 No.
2.	Glass Plate		1 No.
3.	Metal Wire	As per available	As per required
4.	Vernier Callipers		1 No.

FIGURE OF SCREW GAUGE :



SCREW GAUGE

S : CUT SCREW
S_1, S_2 : JAWS TO HOLD OBJECT
F : CURVED FRAME
M : MAIN SCALE
T : STEAM
K : SLEEVE
C : CIRCULAR SCALE
H : MILLED HEAD

THEORY :

The Screw gauge is an instrument used for measuring accurately the diamter of a thin wire or the hicknes of a sheet of metal or glass slab. It consist of a U-shaped frame fitted with a screw spindle

which is attached to a thimble. Parallel to the axis of the thimble a scale graduated in mm is engrave Screw gauge uses a screw to amplify a very small movement, so that it can be easily read. When t fixed stud S_1 and movable stud S_2 are brought in contact without applying any pressure and zero of t circular scale does not coincide with the reference line, there is a zero error. The Screw gauge works the principle of screw. The distance moved by the screw for one complete rotation of head is call Pitch of the screw. The least of the screw can be calculate

$$\text{Least Count} = \frac{\text{Pitch of the Screw}}{\text{Number of divisions on head scale}}$$

PROCEDURE :

a. First determine the least count of the given Screw gauge.

b. The head is rotated through five number of complete rotations. The distance moved by the slop edge over the pitch scale is measured.

$$\text{So the pitch of the Screw} = \frac{\text{Distance moved by Sloped edge over Pitch Scale}}{\text{Number of Rotations of the Screw}}$$

$$\text{Least Count} = \frac{\text{Pitch of the Screw}}{\text{Number of division in head Scale}}$$

c. Then check whether the Screw have any zero error or not, for this rotate the head until S_1 and S_2 a in contact.

d. Check if the zero of the head scale perfectly coincide with the index line then there will be zero err

e. If the zero of the head scale is below the index line such zero error is positive zero error and t correction required is negative and when the zero of the head scale is above the index line su zero error is negative zero error and here for the correction required is positive.

A. Thickness of Glass Plate :

a. The glass plate is held between fix stud S_1 and Screw top S_2 note the completed division on pit scale (Pitch scale reading) (PSR), then the number of head scale division coincide with the inc line is noted (Which is observed head scale reading) n'.

b. If the zero error is 'x', then the corrected value is $(n'-x)$ or $(n'+x)$ is called the head scale read (HSR) 'n'.

Thickness of glass plate = Total reading = PSR + n × LC ..... (i)

c. Changing the position of glass plate five reading taken and thickness is calculated for each readi

d. Take the average of five reading and so that we can get the average thickness of the glass plat

OBSERVATION :

i. Zero error =.....

ii. Zero correction =.....

iii. Distance moved by the head for 5 complete Rotations = ...

iv. Number of head scale division =.....

v. $\text{Pitch of the screw} = \frac{\text{Distance moved by sloped edge on pitch scale}}{\text{Number of rotation of screw}} =$.....

vi. $\text{Least count} = \frac{\text{Pitch of Screw}}{\text{Number of division of head Scale}} =$.....

OBSERVATION TABLE : Thickness of Glass Plate

Sl. No.	Pitch Scale Reading PSR in mm (a)	Observed HSR n'	Correction x	Corrected HSR $n = n' - x$	$b = n \times LC$	Total Reading =a+b in mm
01						
02						
03						
04						
05						

◈ Average thickness of the glass (t) =..... mm.

B. **Volume of Glass Plate :**

Measure the length (l) and breadth (b) using vernier caliper and taking the thickness from above.

we can calculate the volume $= (l) \times (b) \times (t) mm^3$.

OBSERVATION TABLE : Volume of a Glass Plate

Length Measured by Vernier Calliper (l)	Breadth Measured by Vernier Calliper (b)	Thickness Measured by Screw Gauge (t)

CONCLUSION :

ASIGNMENT QUESTIONS

1. How to use a screw gauge ?
2. What do you mean by gauge ?
3. Write down the two main parts of a screw gauge.
4. How pitch is found ?
5. How the least count of a screw gauge is found ?
6. Is there any zero error in Screw gague ? Explain.
7. What are "Precision instrument" ?
8. Does the diameter of the screw depend on temperature ?
9. What is meant by zero error of a screw gauge ?
10. What is the meant by range of the screw gauge ?
11. What is the mechanical advantages of screw gauge ?
12. When is the zero error positive and when it is negative in a screw gauge ?
13. What is the degree of accuracy of the screw gauge ?
14. What are the reasons for a zero error ?
15. What is the principle of a screw gauge ?

EXPERIMENT NO. 03

DATE :..... BRANCH :..... SECTION :.....

NAME :..... REGD. NO. :.....

GRADE :..... COMPLETE :.....

Sign. of Sr. Lect./Lecturer.

AIM OF THE EXPERIMENT :

To find the Volume of a Solid Cylinder using a Vernier Calipers.

OBJECTIVES OF THE EXPERIMENT :

On completion of this experiment, the students will be able to :

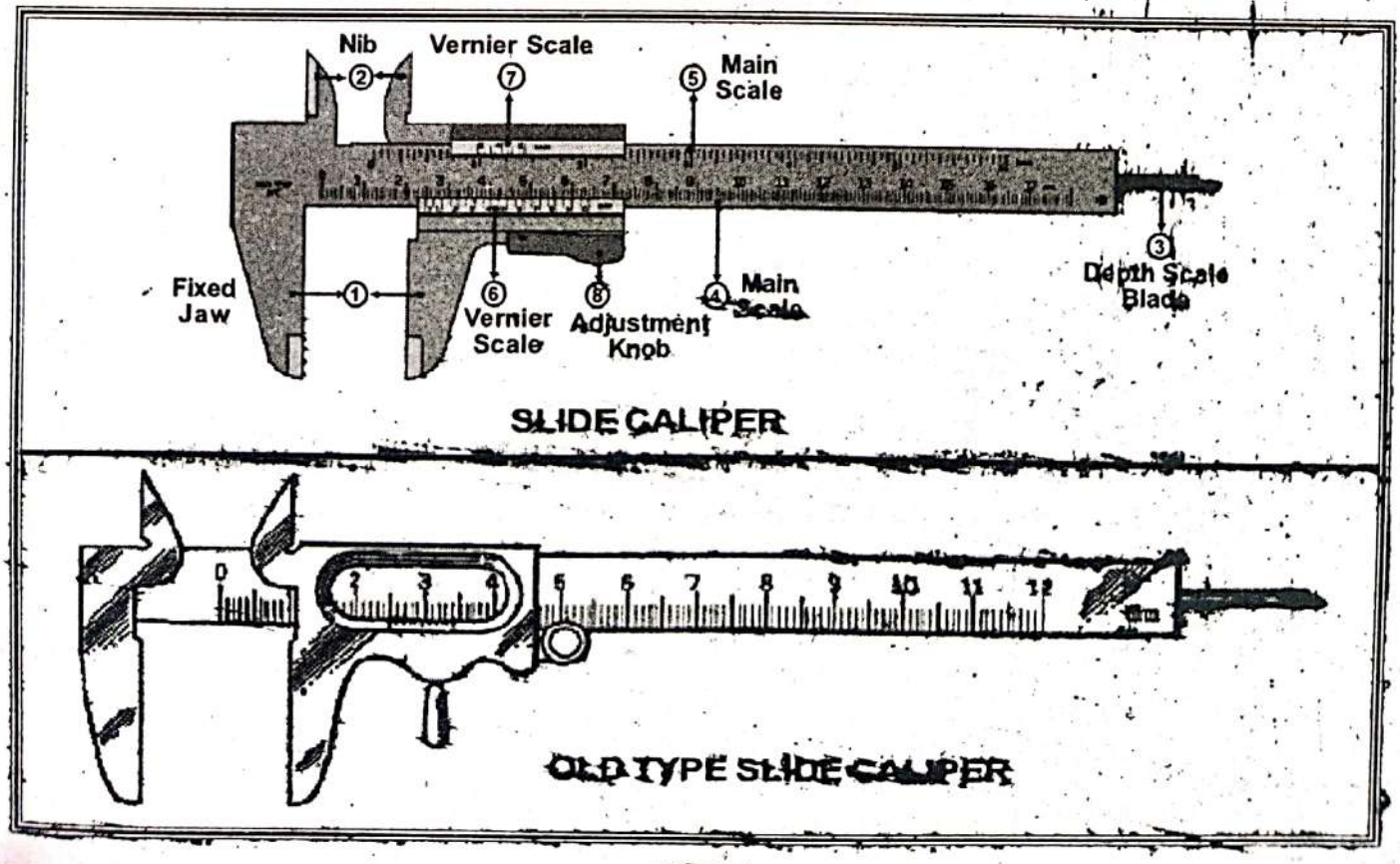
1. Learn the use of vernier calipers for accurate measurement of length.
2. Measure the external diameter of the supplied solid cylinder.
3. Familiar with the use of micrometer calipers for accurate measurement of small lengths.
4. Calculate and find the volume of a solid cylinder using the working formula.

SET UP OF EXPERIMENT :

Apparatus Required :

a.	Slide Calipers	b.	Solid Cylinder	c.	Instrument box

DIAGRAM OF SLIDE CALIPERS :



THEORY :

Least Count = 1 Main scale division – 1 vernier scale division.

Vernier Coincidence : The division of vernier scale coinciding with any division of the main scale.

True reading = Observed reading ± Zero error.

ZERO ERROR :

a. **No zero Error :** when zero of vernier coincides with zero of main scale.

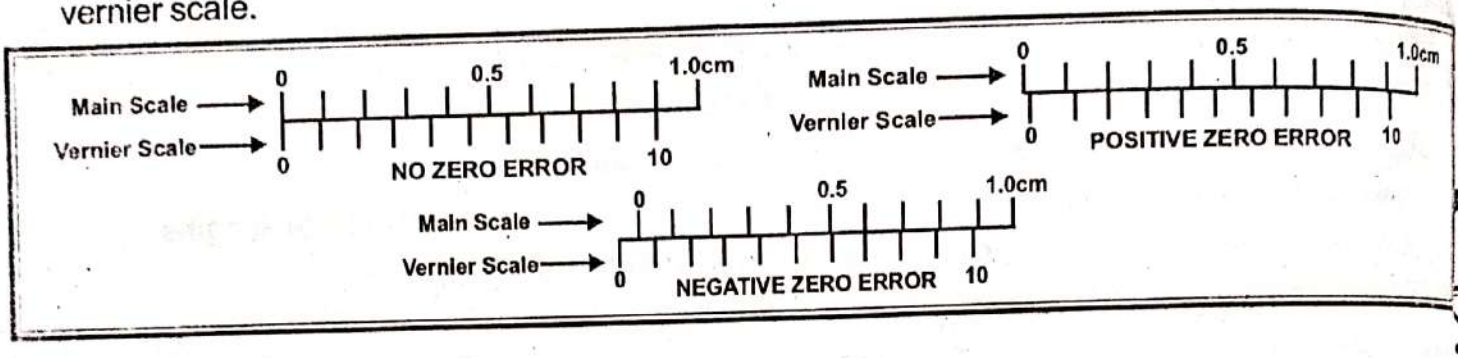
b. **Positive Zero Error :** Zero of vernier scale lies to the right of zero of main scale and the value is to be subtracted from observed reading.

c. **Negative Zero Error :** Zero of vernier lies to the left of zero of main scale and the value is to be added to the observed reading.

CALCULATION OF ZERO ERROR :

Positive Zero Error = L.C. × V.C. (When jaws are closed).

Negative Zero Error = (n – V.C.) L.C. (When jaws are closed) where 'n' is the number of division on vernier scale.



Working Formula :

The volume of a given cylinder (Solid) $= (\pi D^2 h)/4$

Total surface Area of a solid cylinder $= 2\pi rh + 2\pi r^2 = 2\pi r(h + r)$, where

h = height of the cylinder

r = Radius of the cylinder

Length or Diameter of the Cylinder :

- Main Scale Reading + Vernier Scale Reading
- MSR + VSR = MSR + {(V.C.) × L.C.}, where

V.C. = Vernier coincidence

L.C. = Least Count is the least measurement of an instrument.

Calculation of Least Count :

Let 10 V.S.D. = 9M.S.D.

1 V.S.D. = (9 / 10) M.S.D.

L.C. = 1 M.S.D. – 1 V.S.D.

= 1M.S.D. – (9/10)M.S.D. (Putting 1 VSD = 9/10 MSD)

= ((10 – 9) / 10) M.S.D. = (1 / 10 M.S.D.)

We know that, 1 M.S.D. = 0.1 cm or 1 mm

$$1 / 10 \text{ M.S.D.} = \frac{1}{10} \times 0.1 = 0.1 \times 0.1 = 0.01 \text{ cm}$$

So, Least count of slide caliper = **0.01 cm**

ROCEDURE :

Standardize the main scale.

Least count of the given instrument should be calculated.

The given body should be kept in between the two lower jaws lengthwise to determine the length (or height) of the cylinder.

Then the position of zero in vernier scale should be compared with the position of the main scale and main scale reading should be noted which is M.S.R.

Then a particular division out of eleven divisions in Vernier scale, coinciding with any division in M.S. should be watched and then noted as Vernier Coincidence (V.C.)

Now the vernier scale reading (V.S.R.) is calculated by multiplying vernier coincidence with least count i.e. VSR = V.C. × L.C.

So length or height of the given body is to be found by adding M.S.R. with V.S.R. i.e., length / height = MSR + VSR.

Write the result at the end of each tabulation.

Calculate the volume / surface area using the formula given in the theory carefully and then write the conclusion.

BSERVATION TABLE :

: TABULATION FOR LENGTH :

No. of Obs.	L.C. in cm.	Main Scale Reading (MSR) in cm.	Vernier Coincidence (VC) in cm	Vernier Scale Reading (VSR) = (VC × LC) in cm	Observed Diameter in cm (MSR + VSR)	Mean Diameter in cm (D)
1						
2						
3						
4						
5						
6						
7						
8						
9						
0						

ult : Length of the given body is to be found = ... **cm**

- Volume = $\frac{\pi D^2 h}{4}$ = ...

CONCLUSION :

SAFETY AND PRECAUTIONS :

a. Vernier constant and zero error should be carefully found and properly recorded.
b. Note down the Vernier Coincidence by keeping the instrument straight (parallel to the eye.)
c. The solid body should be gripped between the jaws firmly but gently.
d. The procedure should be repeated at least 10 times in different positions of the cylinder since cylinder may not be regular.

ASIGNMENT QUESTIONS

1. Why the Instrument is named as slide calipers ?
2. What do you mean by Least Count in general ?
3. What do you mean by main Scale Reading ?
4. What is the formula to calculate the volume of a solid cylinder ?
5. What do you mean by zero error and how can you calculate zero error ?
6. What do you mean by principle of vernier scale ?
7. What is the advantage of vernier calipers over a regular graduated in millimeters ?
8. What is the use of lower jaws of a vernier calipers ?
9. What is the use of upper jaws of a vernier calipers ?
10. What is the use of the strip moving behind the main scale ?
11. How many types of zero errors will be possible in vernier calipers ?
12. What is positive zero error, how do you correct such error in a vernier calipers ?
13. What negative zero error, how do you correct such error in a vernier calipers ?
14. What is zero correction ? How is it applied ?
15. What are the other measurements that can be made by a vernier calipers ?

WRITTING SPACE FOR ASSIGNMENT

EXPERIMENT NO. 04

DATE :..... BRANCH :..... SECTION :.....

NAME :..... REGD. NO. :.....

GRADE :..... COMPLETE :.....

Sign. of Sr. Lect./Lecturer.

AIM OF THE EXPERIMENT :

To find Volume of a Hollow Cylinder using a Vernier Calipers.

OBJECTIVES OF THE EXPERIMENT :

On completion of this experiment, the students will be able to :

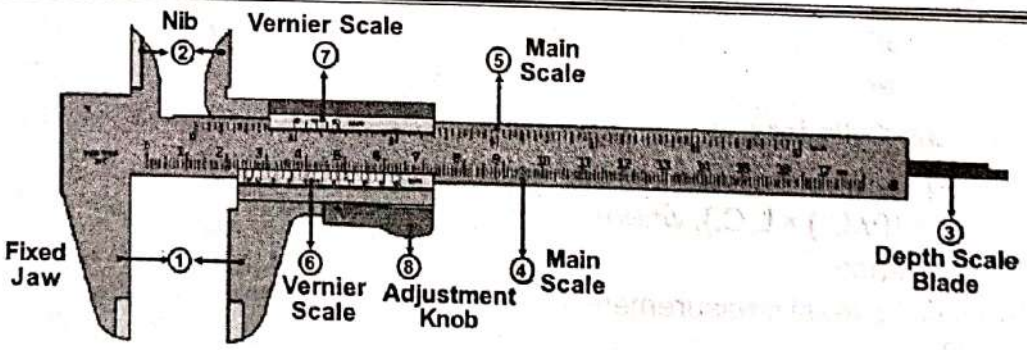
a. Learn the use of vernier caliper for accurate measurement of internal and external diamete hollow cylinder.
b. Measure the internal and external diameter of the supplied hollow cylinder.
c. Familar with the use of micrometer calipers for accurate measurement of small lengths.
d. Calculate the volume of hollow cylinder using the working formula.

SET UP OF EXPERIMENT :

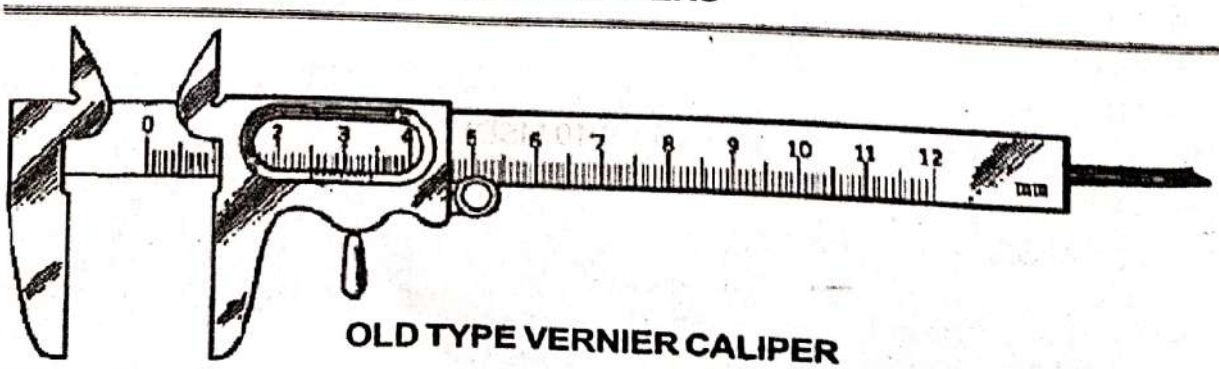
Apparatus Required :

a.	Vernier Calipers	b.	Hollow Cylinder	c.	Instrument box

DIAGRAM OF VERNIER CALIPERS :



VERNIER CALIPERS



OLD TYPE VERNIER CALIPER

HEORY :

Least Count = 1 Main scale division – 1 vernier scale division.

Vernier Coincidence : The division of vernier scale coinciding with any division of the main scale.

True reading = Observed reading ± Zero error.

ERO ERROR :

No zero Error : when zero of vernier coincides with zero of main scale.

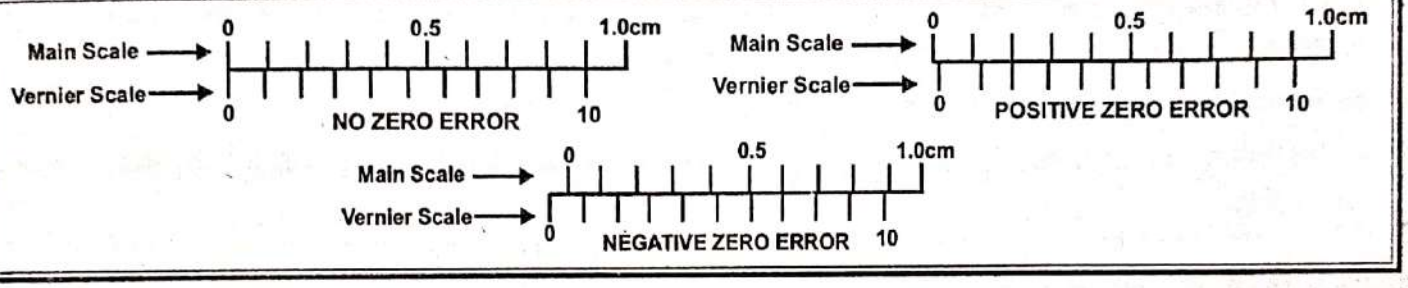
Positive Zero Error : Zero of vernier scale lies to the right of zero of main scale and the value is to be subtracted from observed reading.

Negative Zero Error : Zero of vernier lies to the left of zero of main scale and the value is to be added to the observed reading.

ALCULATION OF ZERO ERROR :

Positive Zero Error = L.C. × V.C. (When jaws are closed).

Negative Zero Error = (n – V.C.) L.C. (When jaws are closed) where 'n' is the number of division on vernier scale.



orking Formula :

The volume of a given cylinder (Hollow) = $\pi(D^2 - d^2)h / 4$, where

D = Diameter (External) = R = Radius = D/2

d = diameter (internal) = r = radius = d/2

h = height of the cylinder

r = Radius of the cylinder

ength or Diameter of the Cylinder :

Main Scale Reading + Vernier Scale Reading

MSR + VSR = MSR + {(V.C.) × L.C.}, where

V.C. = Vernier coincidence

L.C. = Least Count is the least measurement of an instrument.

alculation of Least Count :

Let 10 V.S.D. = 9M.S.D.

1 V.S.D. = (9 / 10) M.S.D.

L.C. = 1 M.S.D. – 1 V.S.D.

= 1M.S.D. – (9/10)M.S.D. (Putting 1 VSD = 9/10 MSD)

= ((10 – 9) / 10) M.S.D. = (1 / 10 M.S.D.)

We know that, 1 M.S.D. = 0.1 cm or 1 mm

$1 / 10 \text{ M.S.D.} = \frac{1}{10} \times 0.1 = 0.1 \times 0.1 = 0.01 \text{ cm}$

So, Least count of slide caliper = **0.01 cm**

PROCEDURE :

a. Standardize the main scale.

b. Least count of the given instrument should be calculated.

c. The given body should be kept in between the two lower jaws lengthwise to determine the length height) of the cylinder.

d. Then the position of zero in vernier scale should be compared with the position of the main sca and main scale reading should be noted which is M.S.R.

e. Then a particular division out of eleven divisions in Vernier scale, coinciding with any division M.S. should be watched and then noted as Vernier Coincidence (V.C.)

f. Now the vernier scale reading (V.S.R.) is calculated by multiplying vernier coincidence with lea count i.e. VSR = V.C. × L.C.

g. So length or height of the given body is to be found by adding M.S.R. with V.S.R. i.e., length / heig = MSR + VSR.

h. Take the mean to find actual length and internal diameter of the given body can be found out placing in between the lower jaws and upper jaws respectively.

i. Write the result at the end of each tabulation.

j. Calculate the volume / surface area using the formula given in the theory carefully and then write conclusion.

OBSERVATION TABLE :

: TABULATION FOR MEASURING EXTERNAL DIAMETER :

No. of Obs.	L.C. in cm.	Main Scale Reading (MSR) in cm.	Vernier Coincidence (VC) in cm	Vernier Scale Reading (VSR) = (VC × LC) in cm	Observed Diameter in cm (MSR + VSR)	Mean Diameter in cm (D)
01						
02						
03						
04						
05						
06						
07						
08						
09						
10						

: TABULATION FOR MEASURING INTERNAL DIAMETER :

No. of Obs.	L.C. in cm.	Main Scale Reading (MSR) in cm.	Vernier Coincidence (VC) in cm	Vernier Scale Reading (VSR) = (VC × LC) in cm	Observed Diameter in cm (MSR + VSR)	Mean Diameter in cm (D)
01						
02						
03						
04						
05						
06						
07						
08						
09						
10						

CALCULATION :

- The Length of the hollow cylinder = ... cm.
- External diameter of the hollow cylinder = ... cm.
- Internal diameter of the hollow cylinder = ... cm.
- Now, putting the values in the formula, we have

a. $V = \pi(D^2 - d^2)h / 4$ = ... cm. and

b. $A = 2\pi r(h + r)$ = ... cm.

CONCLUSION :

SAFETY AND PRECAUTIONS :

a. Vernier constant and zero error should be carefully found and properly recorded.
b. Note down the Vernier Coincidence by keeping the instrument straight (parallel to the eye.)
c. The solid body should be gripped between the jaws firmly but gently.
d. The procedure should be repeated at least 10 times in different positions of the cylinder since the cylinder may not be regular.

ASIGNMENT QUESTIONS

1. What is observed value in vernier caliper ?
2. What do you mean by Least Count in general ?

EXPERIMENT NO. 05

DATE :..... BRANCH :..... SECTION :.....

NAME :..... REGD. NO. :.....

GRADE :..... COMPLETE :.....

Sign. of Sr. Lect./Lecturer.

AIM OF THE EXPERIMENT :

To determine the Radius of Curvature (R) of Convex Surface using a Spherometer :

OBJECTIVES OF THE EXPERIMENT :

On completion of this experiment, the students will able to :

a. Understand the different types of mirrors and their image properties.
b. Know to locate the image of an object in a convex mirror.
c. How light rays are reflected and determine the focal length and radius of curvature of convex surfa
d All real distances are positive while all virtual distances are negative.

SETUP OF EXPERIMENT : ***Equipment / Materials Required :***

SL. NO.	NAME OF THE EQUIPMENT / MATERIAL	RANGE / SPECIFICATION	QUANTITY
1.	Spherometer		1 No.
2.	Convex Mirror		1 No.
3.	Plain Glass Slab		1 No.
4.	Sheet of Paper		1 No.
5.	Rubber		1 No.
6.	Pencil		1 No.

EXPERIMENT FIGURE :

FIGURE OF SPHEREMOTER

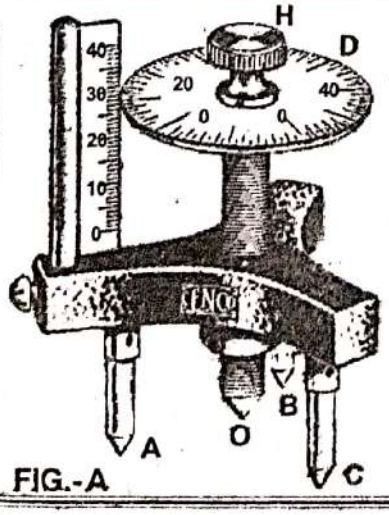


FIG.-A

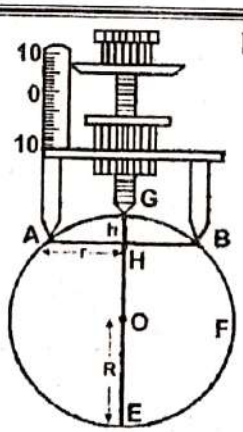


FIG.-B

MEASUREMENT OF RADIUS OF CURVATURE

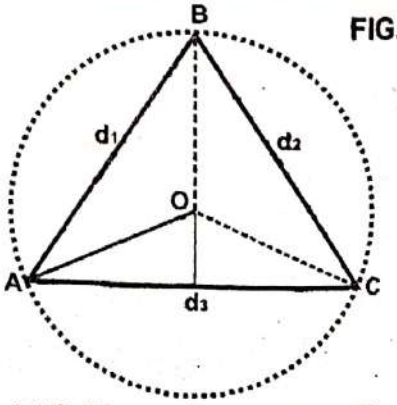


FIG.-C

THE BASE CIRCLE OF THE SPHEROMETER

HEORY :

The radius of curvature 'R' of a curved surface is the radius of the sphere of which the curved surface s a part. This radius of curvature 'R' can be determined by using the formula $R = (d^2 / 6h) + (h / 2)$, where d' is the distance between any two fixed legs of the spherometer.

'h' is the height or depth as observed through the fourth movable leg of the spherometer with respect o the curved surfaces (Convex or Concave).

h = P.S.R + C.S.R.

ROCEDURE :

Raise the central screw of the Spherometer and press the spherometer on the practical note book. So that, to get the pricks of the three legs, mark three points as A, B and C.

Measure the distance between the points by joining the points to form a triangle ABC.

Note the distance AB, BC, AC on the paper sheet and take their mean.

Find the one vertical scale division (Pitch).

Calculate the least count of the spherometer.

Raise the screw sufficiently upward and place the spherometer on the convex surface, so the three legs rest on it.

Turn the screw downward till the screw tip touches the convex surface.

Note down the reading of circular scale which is in line with vertical scale. Let the reading be 'a'.

Remove the spherometer from over the convex surface and place over a plain glass slab.

Turn the screw downward and count the number of complete rotation (n_1) made by the disc.

Continue till the tip of Screw just touches the plain surface of the glass slab.

Note the reading of circular scale, which finally in line with the vertical scale let it be 'b'.

. Find the number of circular scale division in last incomplete rotation.

Repeat step 6 to 14 three times and record it in table.

BSERVATION :

Distance between the two legs of spherometer in ΔABC. In figure 'C' marked by the legs of spherometer

AB = ... cm.

BC = ... cm.

AC = ... cm.

Mean value of $l = \frac{AB + BC + CA}{3} =$ .....

Least count of Spherometer :

1 pitch scale division = 1 mm.

No of full rotations given to screw = 5

Distance moved by screw = 5 mm.

$$\text{Pitch} = P = \frac{5\,\text{mm.}}{5} = 1\,\text{mm.}$$

No of division in circular scale = 100

$$\text{Hence, least count} = \frac{1\,\text{mm}}{100} = 0.001\,\text{cm.}$$

OBSERVATION TABLE :

No. of Observation	Circular Scale Reading		No. of Complete Rotations on Plane glass (n_1)	No. of Disc Scale division incomplete rotation	Total Reading $h = n_1 \times p + x \times l$ in mm
	On Convex Surface Initial (a)	On Plane Glass final (b)			
01					
02					
03					

CALCULATION :

- Find the value of 'h' in each observation.
- Find mean value of 'h' recorded in column 5.

$$\text{Mean value} = h = \frac{h_1 + h_2 + h_3}{3} \text{ mm} = \ldots\ldots\ldots\ldots \text{mm} = \ldots\ldots\ldots\ldots \text{ cm.}$$

- Calculate Radius of curvature, $R = \frac{l^2}{6h} + \frac{h}{2} = \ldots\ldots\ldots\ldots$ cm.

CONCLUSION :

SAFETY AND PRECAUTIONS :

a. Care should be taken to stop the rotation of the screw head after the tip of the screw touches desired surface.
b. The initial reading is to be taken on a higher surface so that to take the final reading the centra is always lowered.
c. The disc is rotated in the same direction before taking each initial and final reading.

ASIGNMENT QUESTIONS

1. What is a Radius of Curvature ?
2. Can you determine Radius of Curvature of Convex Surface ? If yes, how ?
3. Why the instrument is named as spherometer ?
4. What is the radius of curvature of a plane surface ?
5. How the focal length of a lens can be calculate ?
6. What is the radius of curvature of convex mirror ?
7. How do you find the radius of curvature of a curve ?
8. Is the radius of curvature the same as the centre of curvature ?
9. Why are there three legs in a spherometer ?
10. What is the least count of spherometer ?
11. What is the relation between radius of curvature and focal length ?
12. How do you find the pitch of a spherometer ?

EXPERIMENT NO. 06

DATE :..... BRANCH :..... SECTION :.....

NAME :..... REGD. NO. :.....

GRADE :..... COMPLETE :.....

Sign. of Sr. Lect./Lecturer.

AIM OF THE EXPERIMENT :

To determine the Radius of Curvature (R) of Concave Surface using a Spherometer :

OBJECTIVES OF THE EXPERIMENT :

On completion of this experiment, the students will able to :

a. Know to locate the image of an object in a concave mirror.
b. A concave mirror has a positive focal length, while a convex mirror has a negative focal length
c. Whether the image produced by a concave mirror will be real or image.
d. How light rays are reflected and determine the focal length and radius curvature of concave surfa

SETUP OF EXPERIMENT : *Equipment / Materials Required :*

SL. NO.	NAME OF THE EQUIPMENT / MATERIAL	RANGE / SPECIFICATION	QUANTITY
1.	Spherometer		1 No.
2.	Concave Mirror		1 No.
3.	Plain Glass Slab		1 No.
4.	Sheet of Paper		1 No.
5.	Rubber		1 No.
6.	Pencil		1 No.

EXPERIMENT FIGURE :

FIGURE OF SPHEREMOTER

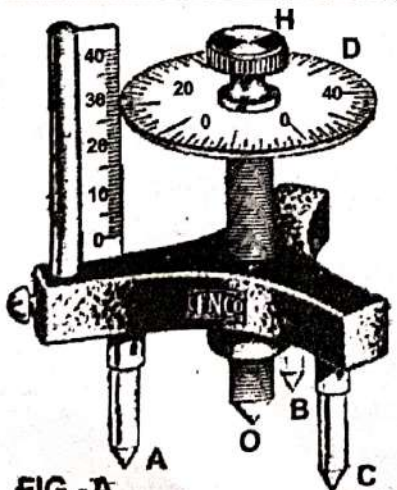
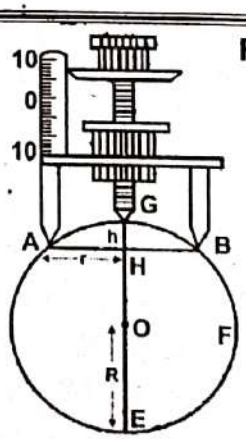


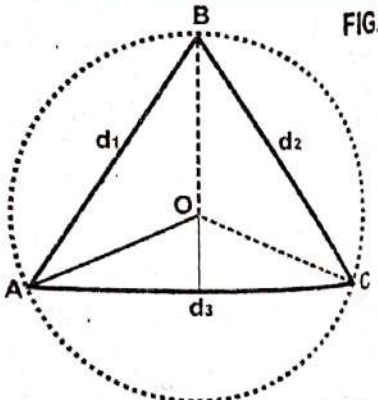
FIG.-A

FIG.- B



MEASUREMENT OF RADIUS OF CURVATURE

FIG.-



THE BASE CIRCLE OF THE SPHEROMETER

'HEORY :

The radius of curvature 'R' of a curved surface is the radius of the sphere of which the curved surface a part. This radius of curvature 'R' can be determined by using the formula $R = (d^2/6h) + (h/2)$, where ' is the distance between any two fixed legs of the spherometer.

'h' is the height or depth as observed through the fourth movable leg of the spherometer with respect the curved surfaces (Concave).

h = P.S.R + C.S.R.

ROCEDURE :

Raise the central screw of the Spherometer and press the spherometer on the practical note book. So that, to get the pricks of the three legs, mark three points as A, B and C.

Measure the distance between the points by joining the points to form a triangle ABC.

Note the distance AB, BC, AC on the paper sheet and take their mean.

Find the one vertical scale division (Pitch).

Calculate the least count of the spherometer.

Raise the screw sufficiently upward and place the spherometer on the Concave surface, so the three legs rest on it.

Turn the screw downward till the screw tip touches the Concave surface.

Note down the reading of circular scale which is in line with vertical scale. Let the reading be 'a'.

Remove the spherometer from over the Concave surface and place over a plain glass slab.

Turn the screw downward and count the number of complete rotation (n_1) made by the disc.

Continue till the tip of Screw just touches the plain surface of the glass slab.

Note the reading of circular scale, which finally in line with the vertical scale let it be 'b'.

Find the number of circular scale division in last incomplete rotation.

Repeat step 6 to 14 three times and record it in table.

BSERVATION :

Distance between the two legs of spherometer in ΔABC. In figure 'C' marked by the legs of spherometer

AB = ... cm.

BC = ... cm.

AC = ... cm.

Mean value of $l = \frac{AB + BC + CA}{3} =$ .....

Least count of Spherometer :

1 pitch scale division = 1 mm.

No of full rotations given to screw = 5

Distance moved by screw = 5 mm.

$$\text{Pitch} = P = \frac{5\,\text{mm.}}{5} = 1\,\text{mm.}$$

No of division in circular scale = 100

$$\text{Hence, least count} = \frac{1\,\text{mm}}{100} = 0.001\,\text{cm.}$$

OBSERVATION TABLE :

No. of Observation	Circular Scale Reading		No. of Complete Rotations on Plane glass (n_1)	No. of Disc Scale division incomplete rotation	Total Reading $h = n_1 \times p + x \times L$ in mm
	On Concave Surface Initial (a)	On Plane Glass final (b)			
01					
02					
03					

CALCULATION :

- Find the value of 'h' in each observation.
- Find mean value of 'h' recorded in column 5.

Mean value $= h = \frac{h_1 + h_2 + h_3}{3}$ mm = ... mm = ... cm.

- Calculate Radius of curvature, $R = \frac{l^2}{6h} + \frac{h}{2}$ = ... cm.

CONCLUSION :

SAFETY AND PRECAUTIONS :

a. Care should be taken to stop the rotation of the screw head after the tip of the screw touches desired surface.

b. The initial reading is to be taken on a higher surface so that to take the final reading the centra is always lowered.

c. The disc is rotated in the same direction before taking each initial and final reading.

ASIGNMENT QUESTIONS

1. Can you determine Radius of Curvature of Concave Surface ? If yes, how ?
2. What is the radius of curvature of Concave mirror ?
3. What happens when a ray parallel to the axis of a concave mirror strikes the mirror ?
4. What happens when a ray through the centre of curvature of a concave mirror strikes the mirro
5. What happens when a ray moves through the focus of a concave mirror ?
6. What is the pitch in case of a spherometer ?
7. Which mirror is used by Dentist ?
8. Why main scale is marked on both sides of zero.
9. What type of image is formed by a concave mirror ?
10. What happens when the object distance equals the focal length ?
11. Why is the image distance always positive for concave mirror ?
12. What is the formula for focal length of a concave mirror ?

EXPERIMENT NO. 07

DATE :..... BRANCH :..... SECTION :.....

NAME :..... REGD. NO. :.....

GRADE :..... COMPLETE :.....

Sign. of Sr. Lect./Lecturer.

AIM OF THE EXPERIMENT :

To Find the Time Period of a Simple Pendulum and determine Acceleration due to Gravity

OBJECTIVES OF THE EXPERIMENT :

On completion of this experiment, the students will be able to :

a. Understand the concept of acceleration due to gravity.
b. Know the concept of simple pendulum.
c. Find the effective length of the simple pendulum for a given time period.
d. Understand the relation between the length of pendulum, time period and acceleration due to gra
e. How the length and time period of a pendulum are related.

Apparatus / Equipment Required :

a.	A solid Metallic bob with Hook.	b.	A piece of thread of about 2 meter.	c.	Meter Scale
d.	A Split Cork	e.	Slide Callipers	f.	Stop Watch
g.	Clamp Stand	h.	Instrument Box		

THEORY :

SIMPLE PENDULUM :

A simple pendulum is a heavy particle point mass suspended from a rigid support by means of an inextens flexible and weightless thread about which it oscillates without friction. A simple pendulum consists of a he spherical bob, suspended by cotton thread from the clamp stand with the help of a split cork.

◆ When a simple pendulum is made to oscillate with small amplitude, it executes simple harmonic mo

AMPLITUDE :

Amplitude is the maximum angular displacement of the Bob from its mean position of rest on ei side. It should be within 4^0 from the mean position of rest while oscillating.

COMPLETE OSCILLATION :

A Bob is said to complete one oscillation, when the bob of the simple pendulum is displaced f certain position and again it comes back to the same position in the direction in which it lift.

TIME PERIOD :

Time Period is the time taken by the simple pendulum to complete one oscillation.

EFFECTIVE LENGTH :

Effective Length of the simple pendulum is the distance from the point of suspension to the cent gravity of the bob. So the effective length = Length of the Thread (l) + length of the hook (h) + radiu the bob (r) $\Rightarrow L = l + r + h$

AWS OF SIMPLE PENDULUM :

aw of Isochronism : Time period of a simple pendulum of given length at a given place is independent of amplitude (if it is within 4^0)

aw of Length : At a given place the time period of a simple pendulum varies directly as the square root of the length i.e., $T \propto \sqrt{L}$

aw of Gravitation :

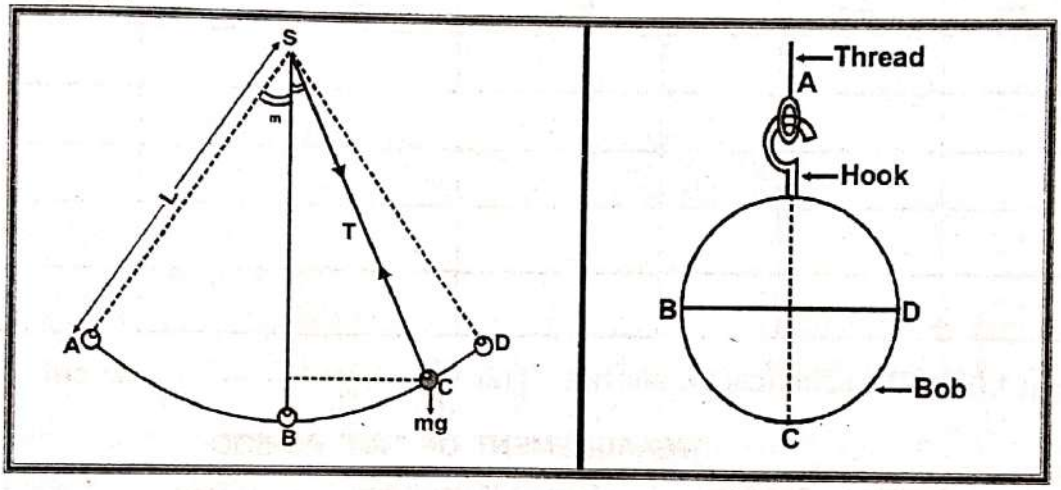
The time period of the simple pendulum at a given place is inversely proportional to the square root of acceleration due to gravity i.e., $T \propto \frac{l}{\sqrt{g}}$

orking Formula :

As we already know that, time period of the simple pendulum (T) varies directly with $\sqrt{L}$ and inversely with $\sqrt{g}$, where **L :** Effective length, **g :** Acceleration due to gravitation and **T :** Time period

$T \propto \sqrt{L} \Rightarrow T \propto l/\sqrt{g} \Rightarrow T = 2\pi^2\sqrt{(L/g)} \Rightarrow T^2 = 4\pi^2 L/g \Rightarrow g = 4\pi^2 L/T^2$

XPERIMENT FIGURE :



ROCEDURE :

Measure the diameter (2r) of the spherical bob with the help of a slide calipers. Calculate the radius of the bob (r).

Then calculate the height of the hook. This is done first by taking the measurement of (2r + h) and 2r is subtracted from it.

Then, determining the length from centre of bob to the top of the hook (r + h). This is the sum of radius and height of hook.

Tie the thread to the hook and stretch tightly along the meter scale with the tied end at the zero of the scale.

Put small ink marks on the thread at places like 30 cm, 40 cm, 50 cm ..... 120 cm.

Then, suspend the pendulum from the clamp stand and between the two halves of the cork in such a way that the mark on the thread corresponding to an effective length should be just at the bottom surface of the cork.

Allow the pendulum to hang vertically at the edge of the table.

Two lines are drawn on the edge of the table to limit the amplitude to 4^0 from mean position of the simple pendulum.

The bob is then allowed to oscillate parallel to the edge of the table. This shows that the oscillation is taking place in a vertical plane.

A stop watch is used to note the time for 10 oscillations for a given length of the pendulum. This is repeated for three times. Time period in each case is noted.

The pendulum is then suspended from other ink marks given earlier and the time periods for 10 oscillations are noted in each case.

Plot L ~ T^2 of graph taking L along X–axis and T^2 along Y–axis.

OBSERVATION :

TABULATION FOR DIAMETER 2R OF THE BOB

No. of Obs.	L.C. in cm	M.S.R in cms	V.C.	V.S.R. in cm (L.C. × V.C.)	Diameter in cm (M.S.R.+ V.S.R.)	Zero Error	Correct Diameter in cm	Mean Diameter 2r in cm	Radius r in cm
01									
02									
03									
04									
05									

TABULATION FOR 2R + H

No. of Obs.	L.C. in cm.	M.S.R. in cms.	V.C.	V.S.R. = L.C. × V.C. in cm.	Total (2r + h) in cm.	Zero Error	Correct (2r + h) in cm.	Mea (2r + in c
01								
02								
03								
04								
05								

Result : (r + h) for the spherical metalic bob = $[(2\bar{r} + \bar{h}) - h]$ = ... in cm

MEASUREMENT OF TIME PERIOD

No. of Obs.	r + h in cm	Length of the Thread (l) in cm	Effective Length of Pendulum $L = l + r + h$	Time for 10 Oscillation in Sec.			Time period T = t/10 Sec.	T^2 in Sec^2	L/T^2 in cm/ sec^2	M L in S
				t_1	t_2	$t = \frac{t_1 + t_2}{2}$				
01			30							
02			40							
03			50							
04			60							
05			70							
06			80							
07			90							
08			100							
09			110							
10			120							

GRAPH :

The L / T^2 is found out from the graph taking 'L' along X–axis and T^2 along Y–axis, which is the eciprocal of the slope. Therefore, slope = T^2 / L or 1 / slope = L / T^2 = ... cm/Sec^2.

Now using formula, $g = 4\pi^2 \times (L / T^2)$ We can, calculate as follows :

Thus $g = 4\pi \times (1 / \text{slope}) =$ .....cm / Sec^2 .

ALCULATION : From theory, $g = 4\pi^2 \, L / T^2$ and from table – III, we have L / T^2 = ... cm / Sec^2

The acceleration due to gravity, $g = 4\pi^2 \times L / T^2$ = ... cm / Sec^2

ONCLUSION :

Acceleration due to gravity by using the iron bob as simple pendulum is found out to be ..... cm / ec^2 i.e..... m/sec^2.

AFETY AND PRECAUTIONS :

1. The amplitude of oscillation of the simple pendulum should not exceed 4^0.
2. The thread must not touch the edge of the table while the pendulum is executing oscillations.
3. Time period must be measured very accurately
4. The beginning of oscillation is noted at the extreme position of the swing on the pendulum

ASIGNMENT QUESTIONS

1. What is the unit of accleration due to gravity ?
2. What do you mean by simple pendulum ?
3. Why does a simple pendulum oscillate when it is distrubed from its mean position of rest ?
4. Why the oscillations of a simple pendulum should take place in the vertical plane ?
5. On what factors the accuracy of results depend in the experiment ?
6. What is the word "simple" represents in case of simple pendulum ?
7. What is the difference between 'G' and 'g' ?
8. What is the relationship between length and period of a pendulum ?
9. What is the frequency formula for simple pendulum ?
10. How does gravity affects the period of pendulum ?
11. Where small 'g' will be smaller at equator or poles ?
12. What is the value of 'g' at sea level ?
13. What is the value of 'g' at the centre gravity of the earth ?
14. Why the amplitude of the pendulum is kept small ?
15. What does acceleration due to gravity means ?
16. How acceleration due to gravity can be calculated ?
17. What is the difference between frequency and period ?
18. What forces act on a pendulum ?
19. From where the length of the pendulum is measured ?

WRITTING SPACE FOR ASSIGNMENT

EXPERIMENT NO. 08

DATE :..... BRANCH :..... SECTION :.....

NAME :..... REGD. NO. :.....

GRADE :..... COMPLETE :.....

Sign. of Sr. Lect./Lecturer.

IM OF THE EXPERIMENT :

To determine the Angle of Prism.

BJECTIVES OF THE EXPERIMENT :

On completion of this experiment, the students will be able to :

In a prism, a ray of light suffers two refraction and the result is deviation.

Know that angle between surfaces is known as refracting angle or angle of prism.

Show the deviation of light by a prism and to indicates that are equilateral triangles.

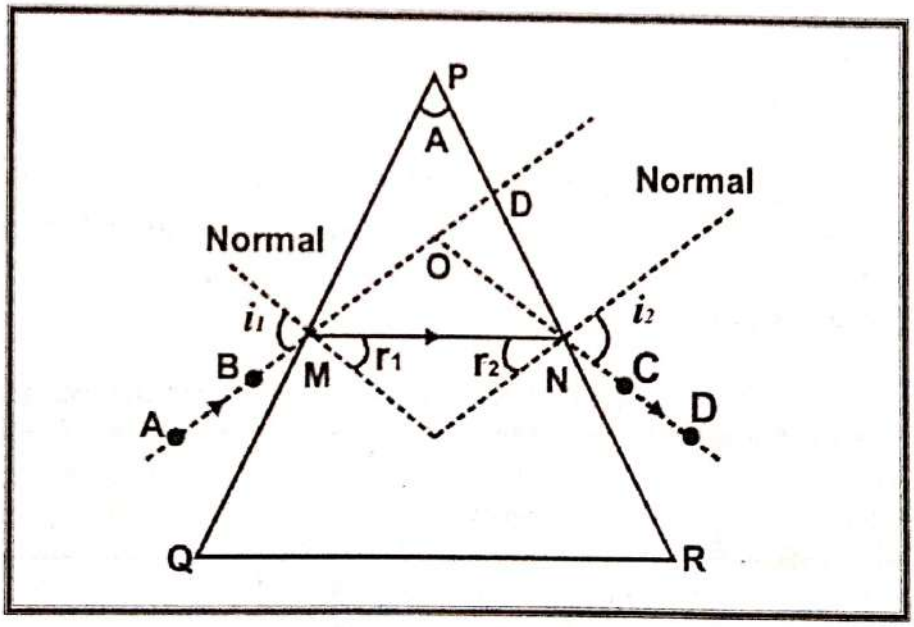
Know that angles between adjacent sides of the prism are 60^0.

Prism split light because different colours of light get refracted by different amount.

pparatus / Equipment Required :

a.	Drawing Board	b.	Fixing Pins
c.	Four Hair Pins	d.	White Paper Sheet
e.	Glass Prism	f.	Meter Scale, Protractor, Pencil etc.

XPERIMENT FIGURE :



HEORY :

The angle between two surfaces is known as refracting angle or angle of prism. In a prism the ray of ght suffers two refraction and the result is deviation.

After passing through a prism the ray of light deviates through a certain angle from its original path.

a. If '*i*' is angle of incidence and '**r**' is angle of refraction, then refractive index = **Sin *i* / Sin r**

b. ***Angle of Deviation*** : The angle between the incident ray and the emergent ray is called angl deviation (D).

c. ***Angle of Minimum Deviation*** : The angle between the incident ray and the emergent ray, when a of incidence is equal to the angle of emergence, is called angle of minimum deviation. It is represe as D_m.

d. ***Angle of Incidence*** : The angle (*i*) between incident ray and normal to the interface is angle of incide

e. ***Angle of Emergence*** : The angle (e) between emergent ray and normal to the interface is called a of emergence.

f. ***Base Angle*** : The angle between incident ray and the interface of refracting surface of prism is c base angle.

PROCEDURE :

a. Take a prism and place it on the white paper sheet in such a way that the triangular base of the p is on the sheet.

b. Draw the line around the prism using a pencil remove the prism.

c. It is a triangle name its vertices P, Q & R.

d. Find the angle between PQ and PR, this is the angle of prism (A).

e. Mark M on the sixde of triangle PQ and also draw a perpendicular to the PQ at M.

f. Place the centre of the protactor at M and along the normal mark an angle of 30^0 and then draw line upto M.

g. This angle is the angle of incedent and note it in table.

h. Place the prism in its position again.

i. Now fix two pins vertically on the line at point A and B.

j. Look for the images of pins through the prism from the other side and fix another two pins at poi and D in such a way that all the four pins appear to lie along same straight line.

k. Now remove the prism and take out the pins.

l. Draw a line joining the two pins holes formed by the pins to meet the surface PR.

m. The angle between the normal at N and emergant ray is the angle of emergence.

n. Join M and N. A, B, M, N, C and D represent path of light.

o. Extend both incedent emergent rays as if they meet at point O and the angle is 2A.

p. Repeat the above procedure thrice to get three values of 2A as shown in the figure and calcualte value of A.

OBSERVATION TABLE :

DETERMINATION OF ANGLE OF PRISM (A)

No of Observation	2A In degrees	Mean value of 2A in degrees	A in degrees
01			
02			
03			

ALCULATION :

ONCLUSION :

AFETY AND PRECAUTIONS :

Pins must be fixed 10 cm apart to avoid parallel.
Ray direction should be given by arrow marks in each case.
The pin positions must be encircled by pencil mark as and when the pins are removed.
The pins must be fixed vertically
Parallel must be avoided

ASIGNMENT QUESTIONS

What is the purpose of a prism ?
What is the angle of deviation in prism ?
What is the angle of prism ?
What is refractive index of a prism ?
Write down function of prism.
Why is the prism or water able to separate the colours of white light ?
What happens when monochromatic light passes through a prism ?
Why does a ray of light passing through a glass slab not show dispersion ?
Why white light dispersed through a prism ?
. What is the dispersive power of a prism ?
. Define angle of dispersion.
. Write down of uses of prism.
. What is the main difference between a pyramid and prism ?
. List the factors responsible for the angle of deviation through prism.
. Why a cylinder is not a prism ?

WRITTING SPACE FOR ASSIGNMENT

EXPERIMENT NO. 09

DATE :..... BRANCH :..... SECTION :.....

NAME :..... REGD. NO. :.....

GRADE :..... COMPLETE :.....

Sign. of Sr. Lect./Lecturer.

AIM OF THE EXPERIMENT :

To determine the Angle of Minimum deviation by I~D curve method.

OBJECTIVES OF THE EXPERIMENT :

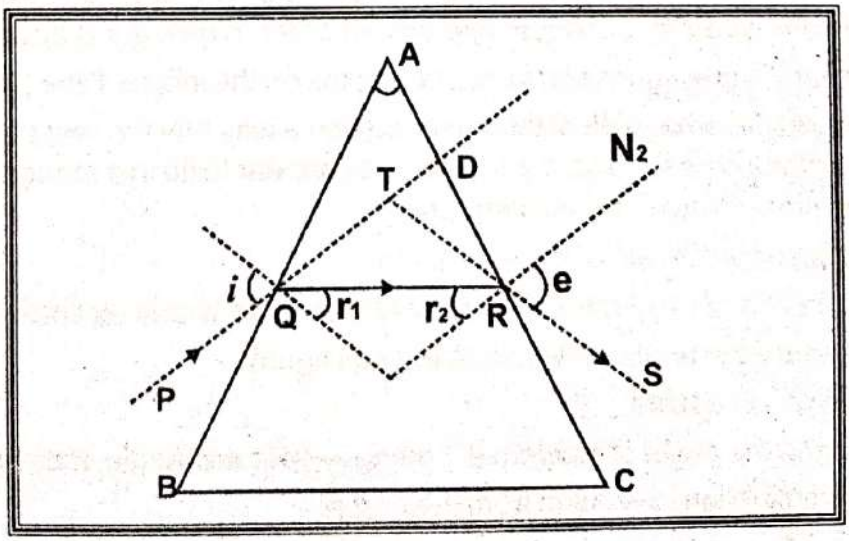
On completion of this experiment, the students will able to :

a. Know the angle of deviation with the angle of incidence.
b. Know the angle of minimum deviation (D) from i–d curve.
c. Find the refractive index of the material of the prism using A and D.
d. Measure angle of deviation for different values of angle of incidence.

SETUP OF EXPERIMENT : ***Equipment / Materials Required :***

SL. NO.	NAME OF THE EQUIPMENT / MATERIAL	RANGE / SPECIFICATION	QUANTITY
1.	Glass Prism		1 No.
2.	Drawing Board		1 No.
3.	Paper		1 No.
4.	Scale		1 No.
5.	Pencil		1 No.
6.	Protractor		1 No.

FIGURE OF PRISM :



THEORY :

a. If 'i' is angle of incidence and 'r' is angle of refraction, then refractive index = Sin i / Sin r

b. *Angle of Deviation* :

The angle between the incident ray and the emergent ray is called angle of deviation (D).

c. *Angle of Minimum Deviation* :

The angle between the incident ray and the emergent ray, when angle of incidence is equal to the ang emergence, is called angle of minimum deviation. It is represented as D_m.

d. *Angle of Incidence* :

The angle (i) between incident ray and normal to the interface is angle of incidence.

e. *Angle of Emergence* :

The angle (e) between emergent ray and normal to the interface is called angle of emergence.

f. *Base Angle* :

The angle between incident ray and the interface of refracting surface of prism is called base ar

g. *Angle of Prism* :

The angle between the transparent plane faces.

From the theory of Prism, we have $\angle D = \angle i + \angle e - \angle A$, Where, D : angle of deviation, i : angle of incidence, e : angle of emergence and A : angle of Prism.

When, $\angle i = \angle e$ then $D = D_m$, the angle of minimum deviation is as : $D_m = 2i - A$

or $i = \frac{A + D_m}{2}$. But, When $\angle i = \angle e$, then angle of refraction is as : $\angle r = A / 2$

According to Snell's Law, we have $\mu = \frac{\text{Sin i}}{\text{Sin r}} = \frac{\text{Sin}\left(\frac{A + D_m}{2}\right)}{\text{Sin}\frac{A}{2}}$

PROCEDURE :

a. Fix the white paper sheet on the drawing board using the fixing pins.

b. Draw a straight line on the middle of the paper covering the entire length of the paper.

c. Draw outlines of Prism seven times with little gap between two figures along this line as in the given fig

d. Draw seven inclined lines to the seven figures making angle 30°, 35°, 40°, 45°, 50°, 55° and 60°. Th lines serve as incident rays and these incident angles are (90 – 30)°, (90 – 40)°, ... (90 – 60)°. Th lines are drawn quite apart and at equal distance in order to give good apperance.

e. Now, place the prism on one figure and fix two heair pins on the inclined line (incident ray)

f. Fix two more pins on the other side of the prism in such a way that the feet of these two pins and image of the feet of the pins fixed on the incident ray appear to lie in a straight line. The straight joining these two pins behave as emergent ray.

g. Follow this procedure for the rest of the six figures.

h. a. Remove the prism and produce the incident and emergent rays as shown in the figure.
   b. Mark and measure the angle of deviation in each figure.

i. Note the observations in a table.

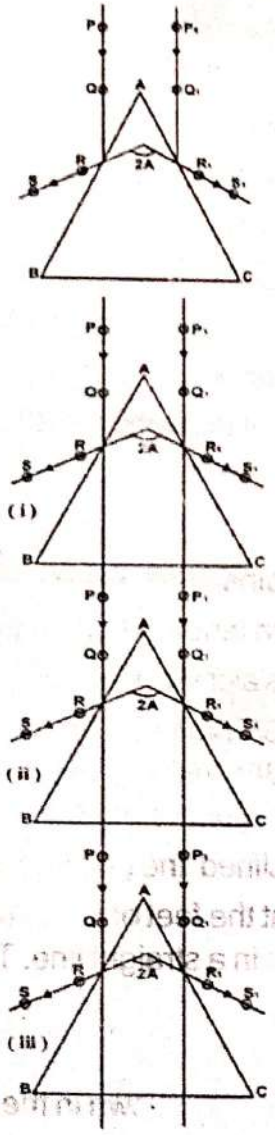
j. Plot a graph between the angle of incidence 'i' along X–axis and angle of deviation 'D' along Y–a

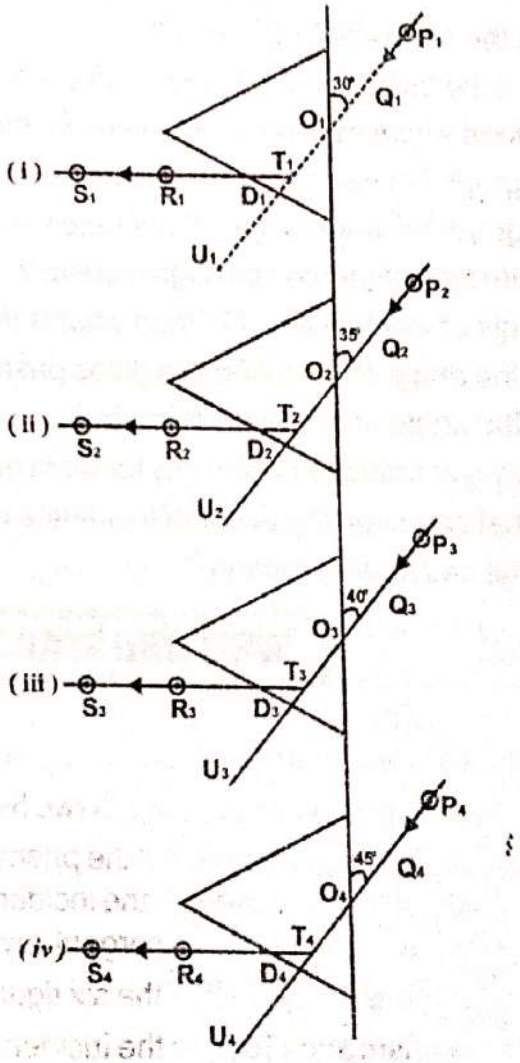
k. Determine angle of minimum deviation from the graph.

: DETERMINATION OF ANGLE OF MINIMUM DEVIATION (D_m) :

Figure Number	Base Angle in degree	Angle of incidence (i) in degree	Angle of deviation (D) in degree	Angle of Minimum deviation (Dm) in degree from graph
01	30^0			
02	35^0			
03	40^0			
04	45^0			
05	50^0			
06	55^0			
07	60^0			

GRAPH AND FIGURES :





CALCULATION :

- The mean value of angle of Prism A = ...
- The angle of minimum deviation D_m = ... (From table)

◈ Refractive index $\mu = \dfrac{\text{Sin}\left(\dfrac{A+D_m}{2}\right)}{\text{Sin}\left(\dfrac{A}{2}\right)} = \ldots\ldots\ldots\ldots$

CONCLUSION :

SAFETY AND PRECAUTIONS :

a. Pins must be fixed 10 cm apart to avoid parallel.
b. Ray direction should be given by arrow marks in each case.
c. The pin positions must be encircled by pencil mark as and when the pins are removed.
d. The pins must be fixed vertically and parallel must be avoided.

ASIGNMENT QUESTIONS

1. What is the nature of i ~ D curve ?
2. What are the laws of reflection and refraction ?
3. When does a light ray suffer minimum deviation through a prism ?
4. Draw a graph between angle of incidence and angle of emergence.
5. Draw a graph between angle of incidence and angle of refraction ?
6. Why white light dispersed through a prism ?
7. If the angle of incidence is 30^0, then what is the angle of deviation ?
8. What is the angle of deviation in a glass prism, when the angle of incidence is 45^0 ?
9. What is the angle of deviation of prism ?
10. Are the laws of reflection valid only for plain mirror ?
11. Under what condition the angle of incidence equals angle of emergence in a prism ?
12. What is the cause of refraction ?

WRITTING SPACE FOR ASSIGNMENT

EXPERIMENT NO. 10

DATE :..... BRANCH :..... SECTION :.....

NAME :..... REGD. NO. :.....

GRADE :..... COMPLETE :.....

Sign. of Sr. Lect./Lecturer.

AIM OF THE EXPERIMENT :

To Trace lines of force due to a Bar Magnet with North–Pole Pointing North (N → N) and lo the Neutral Points.:

OBJECTIVES OF THE EXPERIMENT :

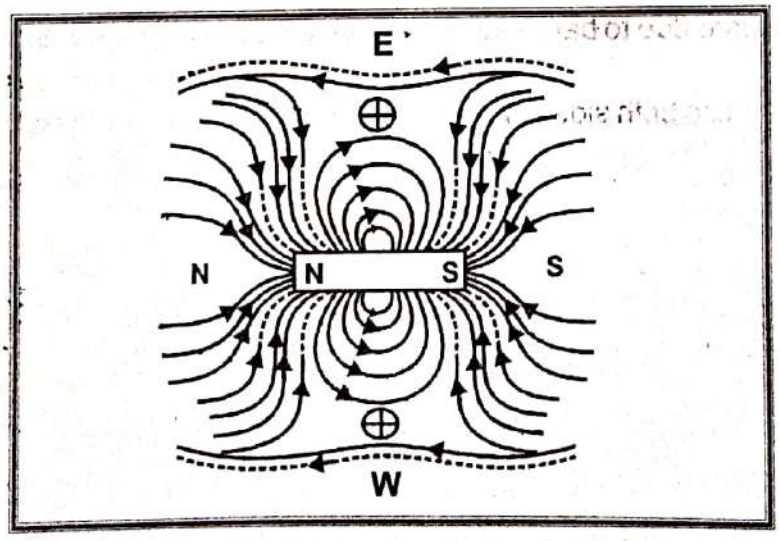
On completion of this experiment, the students will be able to :

a. Know the concept of magnetic field and lines of force.
b. Examine the mangetic field associate with a bar magnet and construct the magnetic field.
c. Study the behaviour of bar magnetic by changing the lines of pole configuration.
d. Know how magnetic lines of force enter and exist a bar magnet.

Apparatus / Equipment Required :

a.	A Bar Magnet	b.	A Compass Needle
c.	A Drawing Board	d.	Fixing Pins / Cello Tape
e.	A Sheet of White Paper	f.	A Meter Scale / Instrument Box

EXPERIMENT FIGURE :



THEORY :

Line of Force :

Line of force is a closed imaginary curve starting from the north pole and ending in the south pol magnetic field such that the tangent drawn at any point on the curve gives the direction of resul magnetic field at that point.

◆ *Two lines of forces never intersect and if they intersect by any means (or mistake), then two tangents may be drawn at that point which is impossible.*

Neutral Point :

Neutral Point is a point in the magnetic field where the field due to bar magnet is equal and opposite to the horizontal intensity of earth's magnetic field. So, if a compass needle is placed at this point then it will tend to remain in any direction in which it is kept.

◆ *Neutral Points are located symmetrically with respect to the magnet on Board–side–on position when North Pole of the magnet points North* ($N \rightarrow N$).

Magnetic Field :

Magnetic Field is the space surrounding the magnet in which the magnetic influence due to the magnet can be realized.

Pole :

Pole is a point situated near the two ends of the magnet where the force of action due to the magnet initiates. A magnet has two poles named as : **North and South.**

Magnetic Length :

Magnetic Length is the distance between the two end points of the bar magnet.

PROCEDURE :

a. Stretch the paper sheet over drawing board and fix it with non magnetic fixing pins or cello tape
b. Determine the geographic North and South with magnetic needle.
c. Find the magnetic meridian with the help of magnetic needle and horizontal thread.
d. Place the bar magnet along the magnetic meterials with its north pole pointing north.
e. Place the magnetic needle near one pole of magnet (North Pole).
f. Put two dot marks on the paper corresponding to the position of both ends of needle when it is at rest.
g. Place the magnetic needle at the subsequent position so that one end of it coincides with the farther dot already plotted.
h. Mark the other end with a dot.
i. Continue the process till a series of dot marks are obtained between the two poles of magnet.
j. Join all the dot marks with a smooth curve to get a lines of force.
k. Draw several lines of force due to bar magnet in earth's magnetic field symmetrically on both sides of paper.
l. Locate the neutral points on both sides of the magnet and show it with crossed – circles as shown in the figure.

OBSERVATION :

CONCLUSION :

SAFETY AND PRECAUTIONS :

r. The drawing board should not be disturbed or turned during the experiment.
). The dot marks should be joined by a smooth curve and not by straight lines.

c. A very short magnetic needle should be chosen.
d. The direction of the lines of force should be given.
e. Ensure that no two lines of force intersect each other.

ASIGNMENT QUESTIONS

1. How can you determine neutral point ?
2. Are the neutral points equidistant from magnetic axis ?
3. Does the line joining neutral points bisects the magnetic length of the bar magnet ?
4. What happens to the neutral point if the magnet is slightly rotated ?
5. Why two lines of force never intersect each other ?
6. Why we use a very short magnetic needle but not a large compass needle ?
7. What do you mean by magnetic meridian and geographic meridian ?
8. What do you mean by a magnetic pole ?
9. What is the net magnetic force at the neutral point ?
10. Where do the neutral points lie when a bar magnet is placed its north pole pointing south ?
11. What the the lines around the bar manget indicates ?
12. Write down any two properties of magnetic field lines.
13. What are the two ways in which you can trace the magnetic field pattern of a bar magnet ?
14. You are given the magnetic field pattern of a magnet. How will you find out from it where the mag field is the strongest ?
15. What is the difference between magnetic lines of force and electric lines for force ?
16. Is magnetic field intensity a scalar or vector quantity ?
17. Write down the difference between permanent magnet and electromagnet.
18. Write down the unit of flux density.

WRITTING SPACE FOR ASSIGNMENT

EXPERIMENT NO. 11

DATE :..... BRANCH :..... SECTION :.....

NAME :..... REGD. NO. :.....

GRADE :..... COMPLETE :.....

Sign. of Sr. Lect./Lecturer.

AIM OF THE EXPERIMENT :

To Draw the Magnetic Lines of Force and Locate the Neutral points due to a Bar Magnet North–Pole of the Magnet Pointing South (N → S) :

OBJECTIVES OF THE EXPERIMENT :

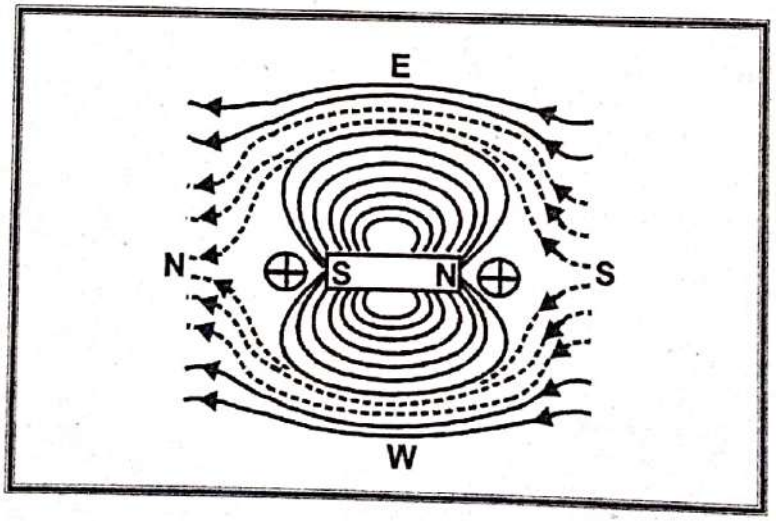
On completion of this experiment, the students will be able to :

a. Define Lines of force.
b. Define magnetic meridian and find out its position.
c. Draw magnetic lines of force and give the directions.
d. Locate the neutral points.

Apparatus / Equipment Required :

a.	A Bar Magnet	b.	A Compass Needle
c.	A Drawing Board	d.	Fixing Pins / Cello Tape
e.	A Sheet of White Paper	f.	A Meter Scale / Instrument Box

EXPERIMENT FIGURE :



THEORY :

Lines of Force :

Line of force is a closed imaginary curve starting from the North pole and ending in the south pole magnetic field such that the tangent drawn at any point on the curve gives the direction of resultant magnetic field at that point.

◈ *Two lines of forces never intersect and if they intersect by any means (or mistake), then two tangents may be drawn at that point which is impossible.*

Neutral Point :

Neutral Point is a point in the magnetic field where the field due to bar magnet is equal and opposite to the horizontal intensity of earth's magnetic field. So, if a compass needle is placed at this point then it will tend to remain in any direction in which it is kept.

◈ *Neutral Points are located symmetrically with respect to the magnet on End–side–on position when North Pole of the magnet points North (N → S).*

Magnetic Field :

Magnetic Field is the space surrounding the magnet in which the magnetic influence due to the magnet can be realised.

Pole :

Pole is a point situated near the two ends of the magnet where the force of action due to the magnet initiates. A magnet has two poles named as : **North** and **South**.

Magnetic Length :

Magnetic Length is the distance between the two end points of the bar magnet.

PROCEDURE :

a. Stretch the paper sheet over drawing board and fix it with non magnetic fixing pins / cello tape.
b. Determine the geographic North and South with magnetic needle.
c. Find the magnetic meridian with the help of magnetic needle and horizontal thread.
d. Place the bar magnet along the magnetic meridian with its north pole pointing south.
e. Place the magnetic needle near one pole of magnet (North Pole).
f. Put two dot marks on the paper corresponding to the position of both ends of needle when it is at rest.
g. Place the magnetic needle at the subsequent position so that one end of it coincides with the farther dot already plotted.
h. Mark the other end with a dot.
i. Continue the process till a series of dot marks are obtained between the two poles of magnet.
j. Join all the dot marks by a smooth curve to get a line of force.
k. Draw several lines of force due to bar magnet in earth's magnetic field symmetrically on both sides of paper.
l. Locate the neutral points on both ends of the magnet on it's axis and show it with crossed – circles.

OBSERVATION :

Find out the distance of two neutral points from the mid point of the magnet and then find the mean distance.

CONCLUSION :

The lines of force never intersect each other and the neutral points are situated on the magnetic axis of the magnet. **Neutral Points** were found at a distance ..... cm from the centre of the magnet and located on End–side– on position with respect to the magnet and the map of the magnetic field in which a number of lines of forces was drawn when N → S.

SAFETY AND PRECAUTIONS :

a. The drawing board should not be disturbed or turned during the experiment.
b. The dot marks should be joined by a smooth curve and not by straight lines.
c. A very short magnetic needle should be chosen
d. The direction of the lines of force should be given.
e. Ensure that no two lines of force intersect each other.

EXPERIMENT NO. 12

DATE :..... BRANCH :..... SECTION :.....

NAME :..... REGD. NO. :.....

GRADE :..... COMPLETE :.....

Sign. of Sr. Lect./Lecturer.

M OF THE EXPERIMENT :

Verification of Ohm's Law by Ammeter – Voltmeter Method :

BJECTIVES OF THE EXPERIMENT :

On completion of this experiment, the students will able to :

Current is directly propertional to voltage.

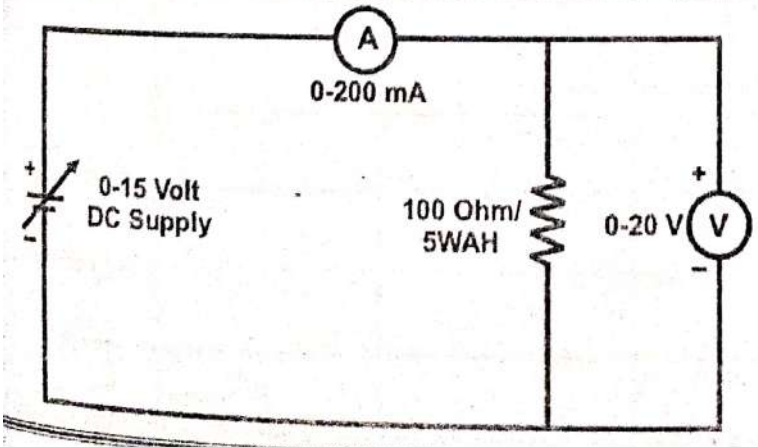
When voltage changes, then current is also changes i.e., resistance remain constant.

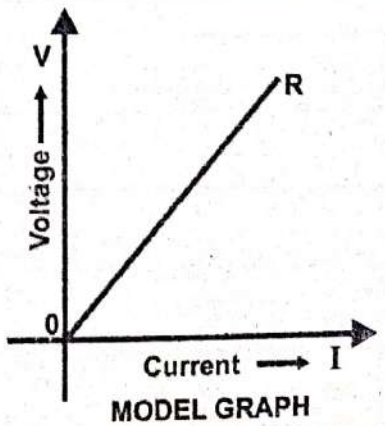
Know the relationship between the components of electricity i.e., Voltage, Current and Resistance.

UIPMENT / MATERIALS REQUIRED :

SL. NO.	NAME OF THE EQUIPMENT / MATERIAL	RANGE / SPECIFICATION	QUANTITY
1.	DC Variable Supply	0 – 15 Volt	1 No.
2.	Digital Multimeter (DMM)	0–20 volt	1 No.
3.	Digital Multimeter (DMM)	mA Range	1 No.
4.	Fixed Resistor	100 Ohm/ 5WAh or more	1 No.
5.	Bread Board	6 × 4″	1 No.
7.	Connecting Wire	22 SWG, Single core	As per required.

RCUIT DIAGRAM :





MODEL GRAPH

THEORY :

Ohm's law is the fundamental law of electrical engineering, it relate the current flowing through resistor to the voltage applied to its ends. According to the statements, the current flowing through constant resistor is directly proportional to the voltage applied to its ends.

OHM'S LAW :

Ohm's Law states that at ***"constant temperature, the potential difference (V) between the ends of a conductor is directly propertional to the current (I) flowing through it"***.

Mathematically, $\boxed{V \propto I \Rightarrow V = RI}$ Where,

'R' is constant of propertionality called as resistance or $\boxed{R = V / I.}$

- If the ratio between potential difference and current can be shown as constant, then the law must be verified.

PROCEDURE :

a. Implement the circuit on the Bread Board as shown in the circuit diagram.
b. Initially set the Vdc supply to 0 volt and note the current on digital multimeter (Ammeter).
c. Increase the voltage to 1 volt and observe the current on digital multimeter (Ammeter).
d. Repeat the above steps for 2 volts, 3 volts up to 10 volts and observe the current on digital multimeter.
e. Plot the graph for the measured voltage and current.
f. Compare the graph with the theoritical value.

OBSERVATION :

	PRACTICAL VALUE			THEORITICAL VALUE		
Sl. No.	Current (mA) in DMM	Voltage (V) in DMM	V/I = R	Current (mA) in DMM	Voltage (V) in DMM	V/I = R
01						
02						
03						
04						
05						
06						
07						
08						
09						
10						

ONCLUSION :

AFETY AND PRECAUTIONS :

The terminals should be screwed tightly
The voltmeter must be connected in parallel and the ammeter in series in the circuit.
The battery should be connected properly
Current is allowed to flow only when the observations are taken
Large currents beyond 1.5 or 2 Amperes should not be drawn.

ASIGNMENT QUESTIONS

What does the current through a wire depend un ?
What is the shape of V-I graph for a linear resistor ?
What is the potential difference required to pass a current of 5 Ampere through a metalic rod of 10 Ohm ?
If the voltage across a fixed value of resistance is increased five times, what will be the variation in current ?
What is the SI unit of resistance ?
State the factors on which the resistance of a conductor depends.
What is an Ohmic resistance ?
What is the resistance of an ideal ammeter ?
What is the resistance of ideal voltmeter ?
. If the resistance in a circuit with constant voltage increases, then the current will be ?
. What happens to current, when potential difference increases ?
. How potential difference varies when current decreases ?
. Calculate the values of resistance 'R' from the slope of the graph.
. What is the role of Voltmeter and Ammeter ?
. Why the Voltmeter is to be connected in parallel to the circuit ?
. Why the ammeter is to be connected in series to the circuit ?
. What is the nature of V ~ I graph at variable temperature ?
. What is the limitation of Ohms law ?
. Can we apply Ohms law to an AC circuit ?

WRITTING SPACE FOR ASSIGNMENT