EXPERIMENT NO. 3
USE OF SPHEROMETER

Aim: To determine the radius of curvature of a spherical surface using a spherometer.

Apparatus: A spherometer, a plane glass plate/mirror spherical mirror or lens or curved glass.

Diagram:

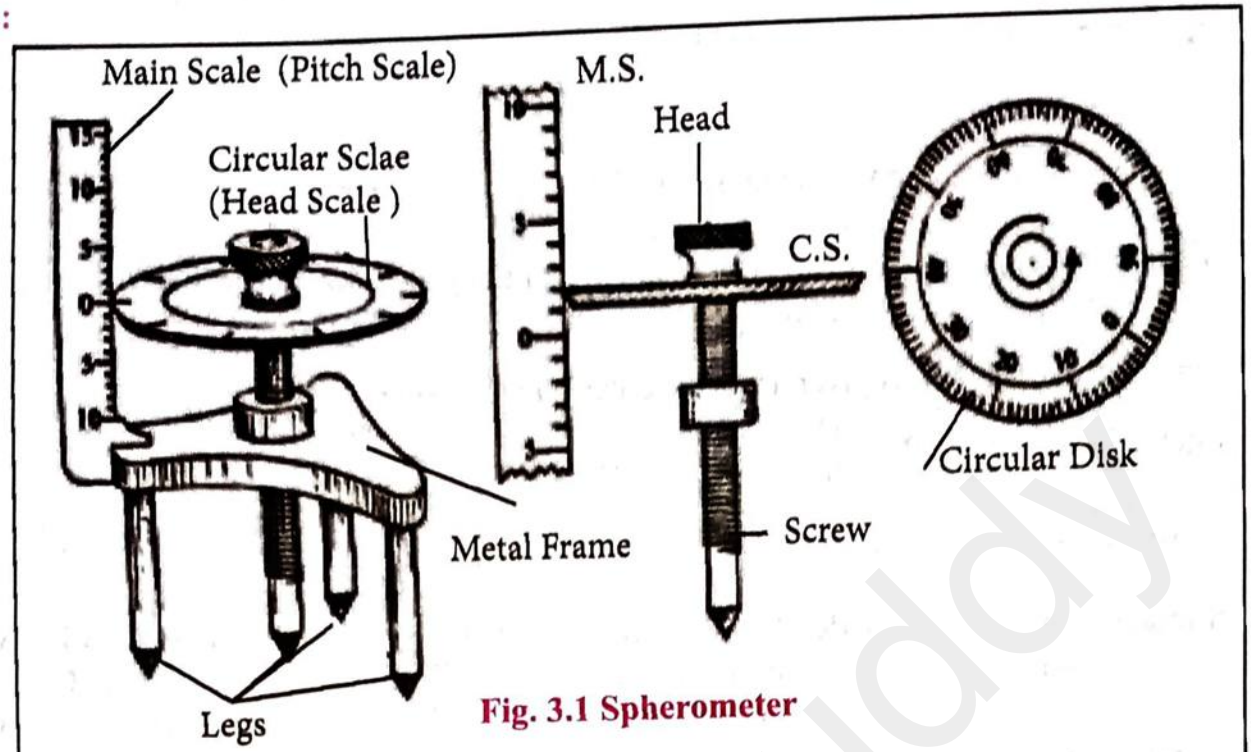

Fig. 3.1 Spherometer

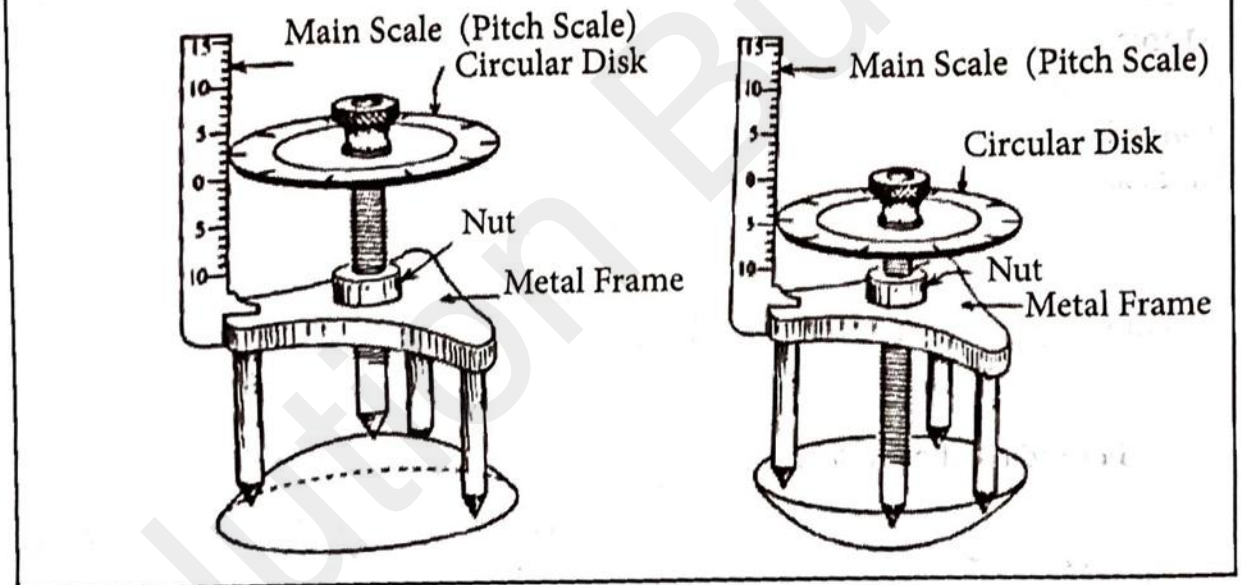

Fig. 3.2 Determination of the radius of curvature of a spherical surface

Formula:

Radius of curvature of the spherical surface. , $R = \frac{a^2}{6h} + \frac{h}{2}$

Procedure:

1. Determine the L.C. of spherometer
2. Record the average distance between three legs of spherometer by taking their impressions on a plane paper.
3. Keep the spherometer on the plane glass plate/mirror and rotate the screw till its tip just touches the plane surface. Note the spherometer reading. Repeat the same once more at a different location.

4. Keep the spherometer on the spherical surface of lens kept on the plane mirror. Adjust the spherometer screw so that its tip just touches the center of spherical surface. Note the spherometer reading. Repeat the same once at a different central location.

Observations:

I. To find average distance between the legs

a_1 = ---3--- cm, a_2 = ---3--- cm, a_3 = ---3--- cm,

$a = \frac{(a_1 + a_2 + a_3)}{3}$ = ...3..... cm.

II. To find the L.C. of spherometer

1. Value of one division on the main scale, S = ...0·1.....cm.
2. Number of divisions on the circular scale, N= .....100...
3. Distance through which the screw advances on the main scale in n rotations of the circular scale = D = ...0·1.....cm.
4. n = number of rotations given to the circular scale = ---1---
5. Pitch of the screw = P = $\frac{D}{n}$ =.....0·1..... cm.
6. Least Count of spherometer = $\frac{P}{N}$ = ...0·001..... cm.

Surface	Obs. no.	Main scale reading A (cm)	Coincident divisions on circular scale B	Circular scale reading (cm) C= (B + L.C.)	Total reading = A+C (cm)	Mean reading (cm)
Plane Mirror	1	1cm	5·5	0·055	1·055	X = 1·055cm
	2	1cm	5·5	0·055	1·055	
Curved surface	1	1·1cm	8·5	0·085	1·185	Y = 1·185cm
	2	1·1cm	8·5	0·085	1·185	

III. To find sagitta (h) :

Sagitta of the spherical surface = h= | X-Y | = ...0·130.....cm

Calculations:

For radius of curvature.

$R = \frac{a^2}{6h} + \frac{h}{2}$

$= \frac{(3)^2}{6(0·130)} + \frac{0·130}{2}$

$= \frac{9}{0·780} + \frac{0·130}{2}$

$= 11·54 + 0·065$ ∴ R = 11·605 cm.

symbol	value	log	
a			
a		+	
-	-		←N
h		+	
-	-		←D
$a^2/6h$	←		←N-D

Result: Radius of curvature of spherical surface = ...11·605..... cm.

Precautions:

1. While taking reading with spherometer consider the lowest division on the main scale as zero.
2. Rotate the screw in one direction to avoid backlash error.
3. Take care that tip of the screw and tip of three legs just touch the surface.

Additional Experiment you can do:

Determine the sagita by placing the spherometer on the concave surface. Hence, determine the Radius of curvature.

Multiple-choice Questions

1. The radius of curvature of a flat surface is ..... cm
   a) 0 b) infinity c) 1 d) 100

2. If the number of divisions on the circular scale are 50 then the L. C. of the spherometer whose pitch is 0.5cm, will be ..... cm
   a) 0.001 b) 0.01 c) 0.05 d).005

Questions

1. How do you determine the pitch of a spherometer?

To find the least count of the spherometer.

measure the distance measured by the screw. Hence, pitch = Distance moved / No. of value (Full) rotation

2. What is radius of curvature of the lens?

Radius of curvature (Rac) has specific meaning and sign convention in optical design A spherical lens or mirror surface has a centre of curvature located either along or decentered from the vertex of the radius of curvature of the surface.

What is sagita of a spherometer?

In this way a spherometer can measure both a positively or negatively curved surface to High accuracy the micrometer measure the distance above or below the plane of the three legs. In the sagilla, referred to using the letter h or s, For depth of glass removed from a lense.

Remark and sign of teacher: .....