Experimental Reading

Pitch (least count of main scale) of spherometer = 1 mm

Least count of vernier (circular) scale of spherometer = 0.01mm

Average distance between any two legs of the spherometer (l) = 4.152 cm measured using Vernier scale

Measurement of curvature of Convex lens:

Using Spherometer radius of curvature (R) can be measured. For this following formula is used.

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

To measure (h) use the following set of readings taken using spherometer:

Serial No.	Spherometer Circular scale reading on lens	Spherometer Circular scale reading on plate	Difference of the two circular scale readings (m)	Number of complete rotations moved (n)	$h = n \times$ (pitch) + $m \times$ (least count of circular scale) (in mm)
1	35	8	27	0	0.27
2	38	6	32	0	0.32
3	39	6	33	0	0.33

Average value of h =0.31mm

$$R = \frac{l^2}{6h} + \frac{h}{2} = \frac{(4.152)^2}{6*0.031} + \frac{0.031}{2} \cong 92.698cm$$

Measurement of the diameter of the fringes

Least count of micrometer on microscope (Vernier scale) = 0.01 mm

Serial No	No. of Ring (n)	Microscope Reading				Diameter = D_n= |left hand side − right hand side| (in cm)
		Left hand side		Right hand side		
		Main Scale reading (in cm)	Vernier scale divisions	Main Scale reading (in cm)	Vernier scale divisions	
1	22	4.65	10	3.95	11	0.699
2	20	4.60	40	3.95	35	0.655
3	18	4.60	18	4.00	01	0.617
4	16	4.60	0	4.00	14	0.586
5	14	4.55	25	4.00	39	0.536
6	12	4.50	45	4.05	03	0.492
7	10	4.50	30	4.05	35	0.445
8	8	4.50	09	4.10	02	0.407
9	6	4.45	30	4.10	34	0.346
10	4	4.40	45	4.15	09	0.286
11	2	4.40	01	4.20	15	0.186

Calculations:

Serial No	No. of Ring (n)	${D_{n+10}}^2$ (For m=10)	${D_n}^2$	$\lambda = \frac{D_{n+m}^2 - D_n^2}{4mR}$ (approx. in nm)
1	12	0.489	0.242	664.893
2	10	0.429	0.198	622.991
3	8	0.381	0.166	579.948
4	6	0.343	0.120	601.415
5	4	0.287	0.082	554.219
6	2	0.242	0.035	559.527

Average wavelength ≅ 597.471 nm

Error Analysis:

Error in curvature of Convex lens:

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

$$\Delta h = 2\Delta l = 0.002cm$$

$\Delta R = \Delta u + \Delta v$ where $u = \frac{l^2}{6h}$ and $v = \frac{h}{2}$

$$\Delta v = \Delta h = 0.002cm$$

$\Delta u = u(2\frac{\Delta l}{l} + \frac{\Delta h}{h}) \cong 3.031$ cm

$\Delta R = \Delta u + \Delta v \cong 3.031 + 0.002 \cong 3.033 \quad cm$

Error in wavelength:

$$\lambda = \frac{D_{n+m}^2 - D_n^2}{4mR}$$

$\Delta\lambda = \lambda(\frac{\Delta a}{a} + \frac{\Delta b}{b})$ where, $a = D_{n+m}^2 - D_n^2$ and $b = 4mR$

$$\frac{\Delta b}{b} = \frac{\Delta R}{R} = 3.27 * 10^{-2}$$

where $\Delta D_{n+m} = \Delta D_n = 2 * least\ count\ of\ vernier\ scale\ reading\ of\ microscope = 2 * 0.001 = 0.002cm$

$$\frac{\Delta a}{a} = \frac{0.004(D_{n+m} - D_n)}{D_{n+m}^2 - D_n^2} = \frac{0.004}{(D_{n+m} + D_n)}$$

$$\Delta\lambda = \lambda(\frac{0.004}{(D_{n+m} + D_n)} + 3.27 * 10^{-2})$$

n	**Wavelength (nm)**	**Error in wavelength (in nm)**
12	660	± 40
10	620	± 40
8	580	± 40
6	600	± 40
4	550	± 40
2	560	± 40