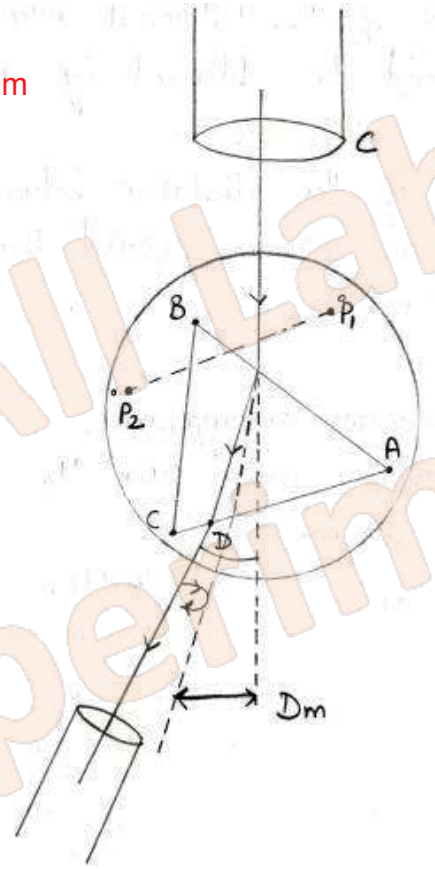
To determine the refractive index of the material of the given prism using a spectrometer.



Observations And Calculations :-

i) for angle of prism -

Position A

	Main Scale Reading	Vernier Scale Reading	Total Scale Reading
V_1	301	6/180 = 0.003	301.003
V_2	120	8/180 = 0.004	120.004

Aim :- To determine the refractive index of the material of the given prism using a spectrometer.

Apparatus :- A spectrometer, sodium lamp, prism, a spirit level, and a reading lens.

Theory :- For the position of minimum deviation, the rays pass symmetrically through the prism. If $\angle i$ is the angle of incidence, $\angle e$ the angle of emergence, $\angle r_1$ and $\angle r_2$ the respective angles of refraction, A the angle of the prism and Dm the angle of minimum deviation, then

$$\angle i = \angle e = i$$

$$\angle r_1 = \angle r_2 = r$$

and $$i + e = A + Dm$$

$$2i = A + Dm$$

$$\rightarrow i = \frac{A + Dm}{2} \quad \text{——— (1)}$$

Also, $$A = r_1 + r_2 = 2r$$

$$\rightarrow r = A/2 \quad \text{——— (2)}$$

the refractive index $\mu = \frac{\sin i}{\sin r}$

Substituting for i and r

$$\mu = \frac{\sin[(A + Dm)/2]}{\sin(A/2)} \quad \text{——— (3)}$$

Position B

	Main Scale Reading	Vernier Scale Reading	Total Scale Reading
V_1	182	3/180	182.016
V_2	2	3/180	2.016

$A_1 = \frac{301.003 - 182.016}{2} = 59.49^\circ$ $\quad A_2 = \frac{120.004 - 2.016}{2} = 58.99^\circ$

$\therefore A = (A_1 + A_2)/2 = (59.49 + 58.99)/2 = 59.24^\circ$

ii) for angle of minimum deviation:-

When prism is there

	Main Scale Reading	Vernier Scale Reading	Total Scale Reading
V_1	300	0	300
V_2	119	0	119

When prism is not there

	Main Scale Reading	Vernier Scale Reading	Total Scale Reading
V_1	249	3/180	249.016
V_2	64	3/180	64.005

$\delta_1 = 300 - 249.016 = 50.984$ $\quad \delta_2 = 119 - 64.005 = 49.995$

$\therefore \delta = \frac{\delta_1 + \delta_2}{2} = \frac{50.984 + 49.995}{2} = 50.49$

Refractive Index of the material of prism -

$$\mu = \frac{\sin\left(\frac{A+\delta}{2}\right)}{\sin\left(\frac{A}{2}\right)}$$

$$\Rightarrow \mu = \frac{\sin(54.865)}{\sin(29.62)} = \frac{0.818}{0.494} = 1.65$$

Result :-

Angle of prism = 59.24°

Refractive Index of material of prism = 1.65

Precautions and Sources of Errors :-

1. The slit should be quite narrow.
2. One of the two - telescope or the prism table - should remain clamped while adjusting them for proper readings.
3. Both the verniers should be read to eliminate the error arising out of the fact that axis of rotation of the prism table or the telescope may not coincide with centre of circular main scale.

Result :- Angle of prism = 59.24°
Refractive Index of material of prism = 1.65