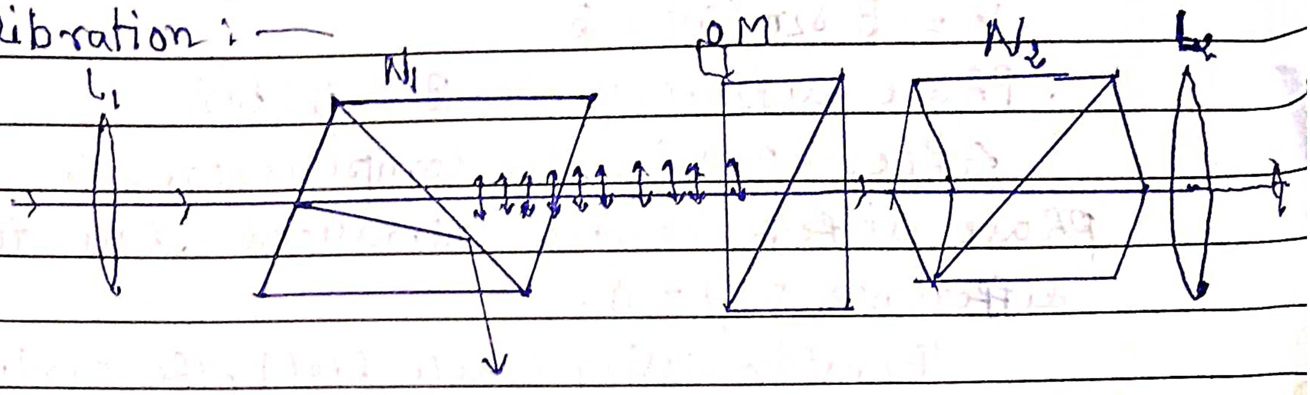
* Analysis of elliptically Polarised light :-

① Calibration :-



To calibrate micrometer screw M, the compensator C is kept between two crossed nicols N_1 (Polariser) and N_2 (analyser).

We suppose that light incident on C is monochromatic and plane polarised. If emergent light after passing N_2 is examined by an eyepiece E then we observe a set of dark fringes corresponding to path difference 0, λ, 2λ, 3λ, ------. Now screw of M is moved so that cross wire of E becomes coincide next dark fringe. Let displacement of M be x.

Thus for displacement of x in M is equivalent to path difference of λ.

$\therefore$ For displacement of a in M is equivalent to Path difference $= \frac{\lambda}{x} \cdot a$

$\therefore$ Corresponding phase difference $= \frac{2\pi}{x} \cdot a$

(2) Phase difference between two components of elliptically polarised light :-

The incident elliptically polarised light on the compensator can be assumed to be made of two mutually perpendicular components. The first components is parallel to optic axis of prism A while the other is perpendicular to it.

They can be represented as

$x = A \sin(\omega t + \alpha)$

$y = B \sin(\omega t + \beta$

$\therefore$ Phase difference $= \alpha - \beta = \phi$ (say)

After passing the compensator, the additional phase difference δ is introduced. Thus total phase difference $= \phi + \delta$.

Firstly using white light, the central dark band is brought under cross wire of eye piece E. Now, the elliptically polarised light is switched on. The central dark band is shifted to new place where phase difference ϕ becomes equal to phase δ produced by compensator M is moved for a displacement b so that the central dark band again comes under cross wire. Thus, $\phi \cdot \frac{\lambda}{2\pi} = \frac{\lambda}{x} \cdot b$

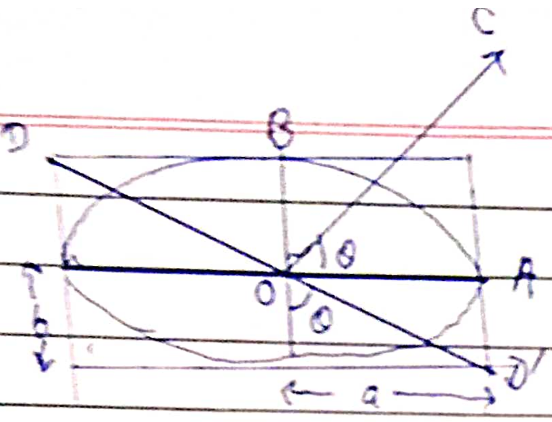
or, $\phi = \frac{2\pi}{x} \cdot b$

(3) Position of axes:—

The central dark band is made coincident to cross wire of E using while light as discussed above. M is moved by $\frac{b}{2}$ so that cross wire now becomes coincident to a band having phase difference of $\frac{\lambda}{2}$. Now allowing the elliptically polarised lights to fall, the compensator C is so moved in its own plane that the central dark band again comes under cross wire. In this position major and minor axes of the elliptically polarised light are parallel to optic axes of prisms of compensator.

(4) Ratio of axes:—

The axes of the ellipse are made parallel to the optic axes of the prisms of compensator as



discussed above. The reading of analyser N_2 is noted. Let OA and OB represents optic axes of prisms of compensator. OC represents the direction of main cross-section of N_2 while DD' represents plane of vibration of light at the cross-wire.

It is clear that

$$\tan\theta = \frac{\text{Semi major axis}}{\text{Semi minor axis}}$$

$$= \frac{OA}{OB}$$

$$\boxed{\tan\theta = \frac{a}{b}}$$

To get the value of θ, analyser N_2 is moved slowly until the appearance of bands ceases completely. The reading of N_2 is noted. The difference of two readings of N_2 gives the value of θ.