Title :- To determine the wavelength of light by Newton's ring method.

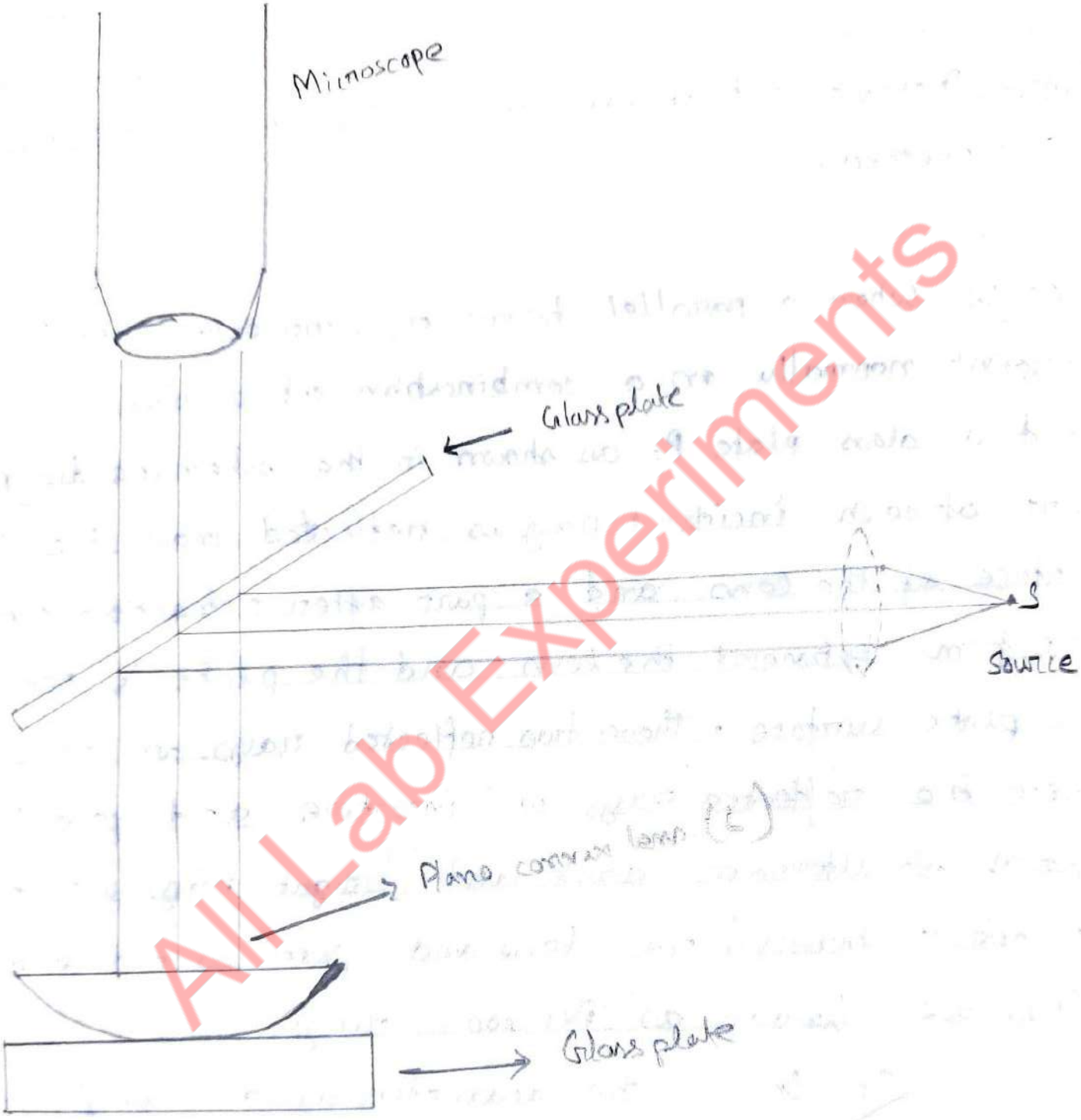
Aim :- Measurement of wavelength of light by Newton's ring method.

Theory :- When a parallel beam of monochromatic light is incident normally on a combination of a plano convex lens L and a glass plate P, as shown in the schematic diagram, a part of each incident ray is reflected from the lower surface of the lens and a part after refraction through the air film between the lens and the plate is reflected from the plate surface. These two reflected rays are coherent. Hence the reflected rays will interfere and produce a system of alternate dark and bright rings with the point of contact between the lens and plate as the centre. These rings are known as Newton's rings.

If D_m is the diameter of m^{th} brightest ring, counted from the centre, we have,

$$\frac{D_m^2}{4R} = (2m+1)\frac{\lambda}{2}$$

Where, R is the radius of curvature of the lower surface of the lens L and λ is the wavelength of the light.



Schematic diagram of experimental set up.

For the $(m+n)$ th bright ring from the centre, we obtain

$$\frac{D^2_{m+n}}{4R} = (2m+2n+1)\,\lambda/2 \quad \text{——— (ii)}$$

Where D_{m+n} is the diameter of $(m+n)$ th ring.

From (i) & (ii) we get,

$$\lambda = \frac{D^2_{m+n} - D_m^2}{4nR} \quad \text{——— (iii)}$$

Equation (iii) is used as the working formula for calculating the wavelength (λ) of light.

Apparatus :- Travelling microscope, Plano convex lens, plaine glass plate (optically flat), reflector, sodium light source.

Experimental Data :-

TABLE :-

* Measurement of the diameters of the rings.

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TABLE

DATE: / /

SL No.	Ring No (m)	Microscope readings (cm) on the Left (L) Main Scale	C.S	Total (a)	Right (R) Main Scale	C.S	Total (b)	Diameter (b-a) (cm)	D^2
1.	5	39×0.1	36×.001	3.936	44×.1	92×0.001	4.492	0.556	0.309
2.	10	38×0.1	33×0.001	3.833	45×0.1	95×0.001	4.595	0.762	0.580
3.	15	37×0.1	66×0.001	3.766	46×0.1	73×0.001	4.673	0.907	0.822
4.	20	37×0.1	1×0.001	3.701	47×0.1	35×0.001	4.735	1.034	1.069
5.	25	36×0.1	40×0.001	3.640	47×0.1	94×0.001	4.799	1.159	1.343

Graph:- A graph is plotted with square of the ring diameter (D^2 m) against the ring diameter.

Result:- The wavelength of light is 5893 Å.

Calculation:-

$$\lambda = \frac{D_{m+n}^2 - D_m^2}{4nR}$$

$$= \frac{0.96 - 0.41}{4 \times 10 \times 200} \times 10^{-8}$$

$$= 6.875 \times 10^{-5}$$

$$= 6875 \text{ Å}$$

% error :- $\left| \frac{6835 - 5893}{5893} \right| \times 100$

$$= 15.9\ \%$$

Precaution & Discussion :-

1. The glass plate and the lens should be very clean before setting up the apparatus.

2. The lens used should be of large radius of curvature.

3. The source of light should be an extended one.

4. Crosswire should be focussed on the ring tangentially.

5. Care must be taken not to disturb the lens and glass plate combination in any way during the experiment.