EXPERIMENT NO.: …….

Aim: - To determine the **fringe width of interference fringes** produced by monochromatic light using a Fresnel Biprism.

Apparatus Required:

S. No.	Name of equipment	Specifications	Quantity	Remark
1.	Optical bench with uprights		1	
2.	Sodium lamp		1	
3.	Biprism		1	
4.	Convex lens		1	
5.	Slit		1	
6.	Micrometer eyepiece		1	

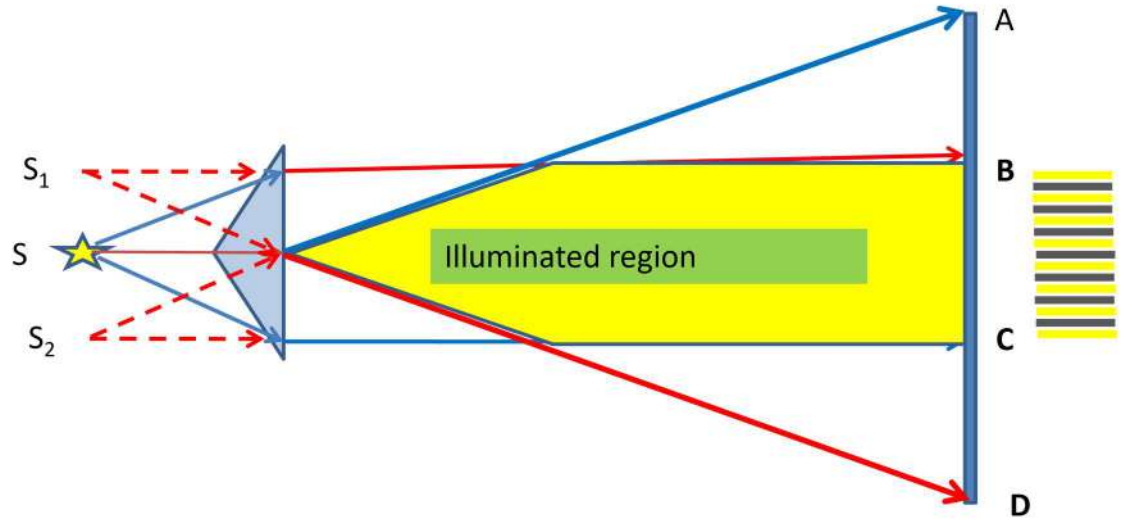
Theoretical Background:

This experiment is based on the principles of interference and formation of two coherent virtual sources. When a monochromatic light such as, sodium light passes through a narrow slit and then encounters a biprism, the prism effectively splits the light into two diverging beams that appear to originate from two virtual coherent sources. These two sources being coherent, interfere with each other to produce an alternating pattern of bright and dark fringes on a distant screen. The bright fringes result from constructive interference and dark fringes are result of destructive interference.

The separation between two fringes is called fringe width (β). It is related to wavelength, distance between slit and screen and distance between two slit is given by:

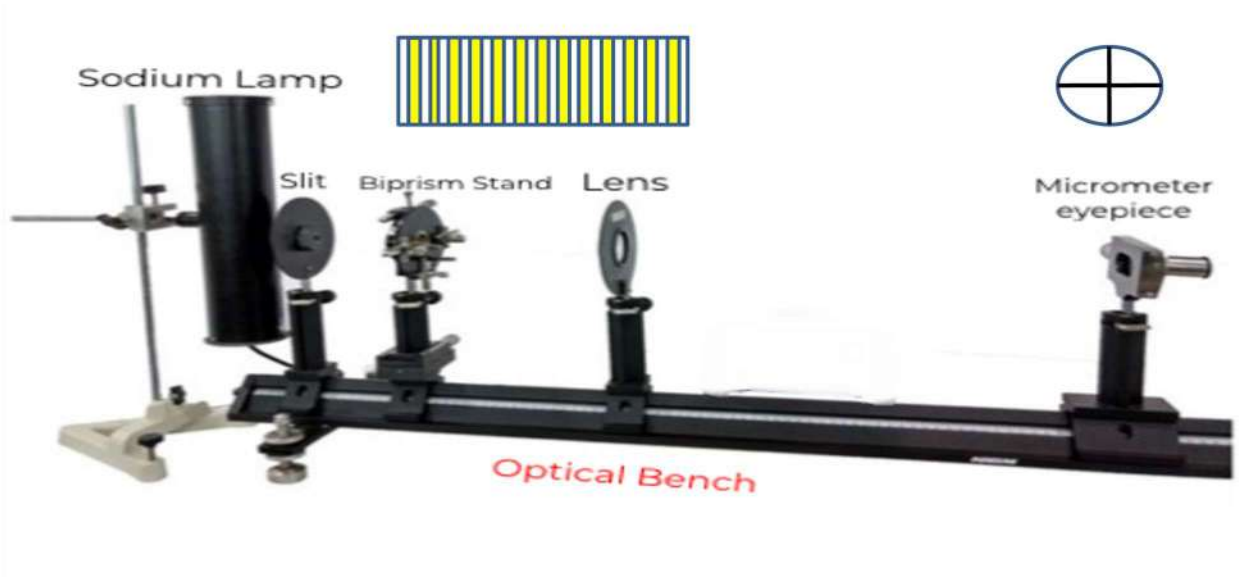
$$\beta = (\lambda * D) / d$$

Where: λ = wavelength
D = distance b/w slit and screen, d = distance b/w 2 virtual sources



With this relation wavelength (λ) of sodium light can be determined. Here d = √(d1 * d2), where d1 = distance b/w images of slit at first position of lens; d2 = distance b/w images of slit at second position of lens.

Experimental Set-up: -



Procedure:

Measurement of fringe width (β)

i) Find out the least count of micrometer screw.

ii) Place the micrometer screw at such a distance from Biprism where fringes are distinct, bright and widely spaced, say 120cm.

iii) The crosswire is moved on one side of fringes to avoid backlash error. Now fix the crosswire at center of the bright fringe of one side.

iv) Note down the position of the bright fringe from micrometer eyepiece.

v) The crosswire is now moved and fixed at center of second fringe. The micrometer readings are noted.

vi) Repeat this process by moving the cross wire upto the bright fringe of other side of spectrum.

vii) From these observations (β) fringe width can be calculated.

Measurement of D:

The distance between slit and eyepiece uprights is noted. This distance gives D. The value of D is corrected for the bench error.

Measurement of d:

The distance d between the two virtual sources can be measured with the help of figure:

1. To obtain the value of d, the positions of slit and Biprism uprights are not disturbed.

2. A convex lens is introduced between Biprism and eyepiece and moved in between the two to obtain the second position to get two sharp images.

3. The lens is placed near to eyepiece and is moved towards biprism till two sharp images of slit are seen. The distance d1 is measured by micrometer eyepiece.

4. Lens is moved towards the biprism till two images are again seen. The distance between these two images is d2.

5. At least 2 sets of observations for d1 and d2 are taken.

Observation Table

1. Measurement of Fringe Width: -

No. of fringes	Micrometer reading (a) (mm)			No. of fringes	Micrometer reading (b) (mm)			Difference c = (a ~ b)	Mean of 10 fringes (c/10) (mm)	Calculated fringe width β (mm)
	m. s.	v. s.	Total (a)		m. s.	v. s.	Total (b)			
1				11						
2				12						
3				13						
4				14						
5				15						
6				16						
7				17						
8				18						
9				19						
10				20						

2. Measurement of D: -

iii) Position of the upright carrying slit (m) = ……...

iv) Position of the upright carrying eyepiece (n) = …….

D = m – n = ……

3. Measurement of d: -

S. No.	Micrometer reading at 1st position of Lens						d_1 = q - p	Micrometer reading at 2nd position of Lens						d_2 = u - v	$d = \sqrt{d_1 d_2}$
	Image I Position			Image II Position				Image I Position			Image II Position				
	m .s.	v. s.	Total (p)	m .s.	v. s.	Total (q)		m .s.	v. s.	Total (u)	m .s.	v. s.	Total (v)		
1															
2															

Calculation: -

Since $\beta = \frac{\lambda D}{d}$

$\beta = \cdots nm$

Interpretation of Result: -

Result: -

The fringe width of sodium light is ……. **nm.**

Precautions:

1) Slits should be narrow and vertical as possible.

2) All uprights should be at same height.

3) Micrometer screw should be rotated in same direction in order to avoid backlash error.

4) The position of slit and biprism should not be changed through the focal length of convex lens while measuring d.

5) Lateral shift of fringes should be removed.

6) Crosswire should be fixed in center of fringe while taking observations for fringe width.

7) Motion of eyepiece should be perpendicular to length of the bench.