5.CONVEX LENS- FOCAL LENGTH

AIM:

To find the values of **v** for various values of **u** in case of convex lens and hence to find its focal length by plotting the u-v graph.

APPARATUS REQUIRED:

Light source, Convex lens, Lens stand,Screen, Meter Scale.

THEORY:

Convex lens is a converging lens, mostly forming real images.The nature and size of image formed depends on the position of the object kept in front of the lens. To find the focal length of the lens, we use the lens formula,

$$\frac{1}{f} = \frac{1}{u} + \frac{1}{v}$$

Where, u–Object distance from the lens (in cm)

v–Image distance from the lens (in cm)

F–focal length of the convex lens (in cm)

According to sign convention, u is always negative value.v and f are always positive.

$$f = \frac{uv}{u+v} \; \text{cm}$$

PROCEDURE:

1. Find the rough focal length of the given convex lens by distant-object method.Note it down.
2. Mount the convex lens on the lens stand.
3. Place the lens from the object(Wire gauze of the light source)at a distance of u=1.5f cm.
4. Move the screen on the other side of the convex lens to get a well defined real and inverted image of the object.

5. Note the distance between the lens and screen as v.

6. Find the focal length of the convex lens using the formula, $f = \dfrac{uv}{u+v}$

7. Repeat the experiment for different values of u in steps of 2cm.

8. The average value of f gives the experimental value of focal length of the lens.

9. Plot u=v graph and find the graphical value of 'f'.

RESULT:

1. The u-v graph is plotted and is a curve.

2. Focal length of the convex lens,
   - By distant object method, f = ...cm

   - By u-v experiment, f =...cm

   - By u-v Graph,f=...cm

PRECAUTIONS:

1. The optic center of the convex lens, object and the screen all should lie on the same line.

2. Do not place the object closer to the rough focal length of the lens. This may produce only a virtual image.

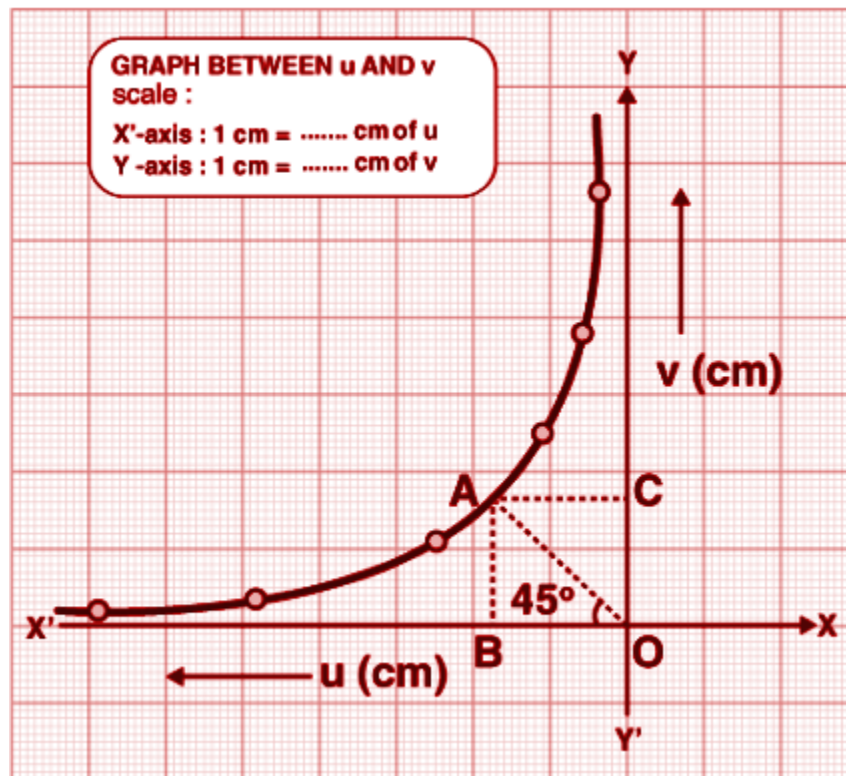3. Take equal and same scale on X and Y axis while plotting u-v graph.

SOURCES OF ERROR:

1. The lens may not be free from aberrations like spherical, chromatic aberrations.

2. Uprights may not be vertical.

3. The scale chosen on the graph may not be equal or accurate.

RAY DIAGRAM:

MODEL GRAPH:

GRAPH BETWEEN u AND v
scale :
X'-axis : 1 cm = ... cm of u
Y -axis : 1 cm = ... cm of v
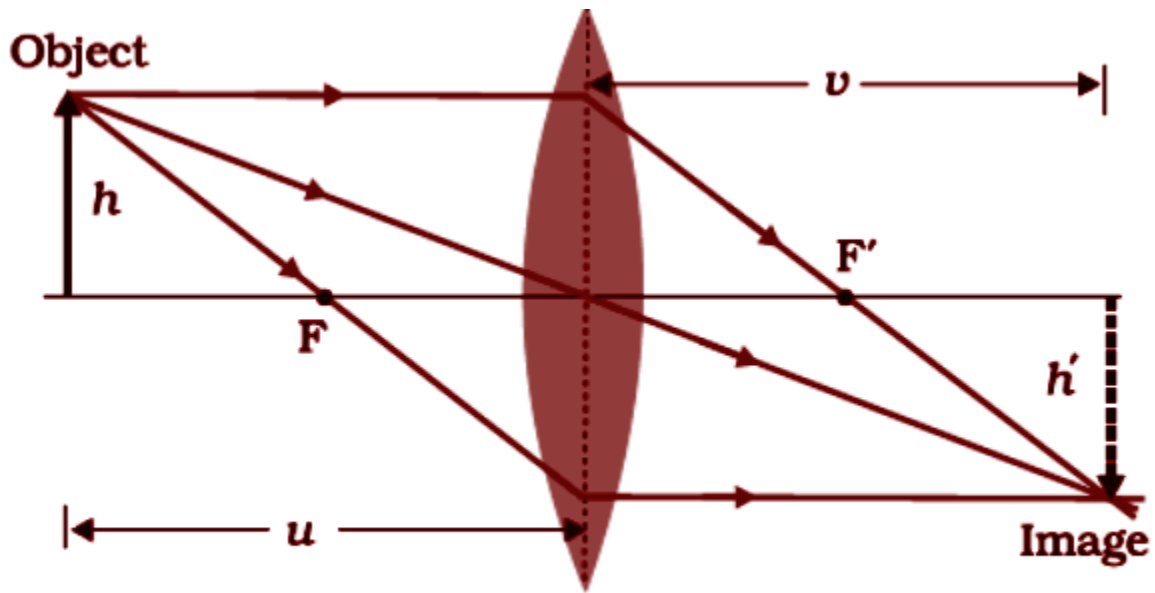
OBSERVATIONS & TABULATIONS;

Rough focal length of the convex lens, F =.......................cm (by distant object method)

Sl.No	Object distance u (cm)	Image distance v (cm)	$f = \dfrac{uv}{u+v}$ (cm)
1.			
2.			
3.			
4.			
5.			
6.			

CALCULATION:

Mean Focal length, $F = \dfrac{F_1+F_2+F_3+F_4+F_5+F_6}{6}$.......................................cm

Focal length from graph $F = \dfrac{OC+OB}{4}$=..cm