**Concave Mirror**

**AIM:** To find the value of \( v \) for the different values of \( u \) in case of a concave mirror and find the focal length.

**APPARATUS REQUIRED:**
- An optical bench with three concave mirrors, a holder, two needles, knitting needle, a card board, half meter rod.

**RAY DIAGRAM:** (see alongside)

**THEORY AND FORMULA:**
From the mirror formula,

\[
\frac{1}{f} = \frac{1}{v} + \frac{1}{u} \quad \text{or} \quad \frac{1}{f} = \frac{u + v}{uv}
\]

\[ f = \frac{uv}{u+v} \]

**PROCEDURE:**
1) Take the given concave mirror and mount it on holder in an upright position. Go out in the open and turn the reflecting face of the mirror towards any distant objects like pole, tree etc. Also hold card board
screen in another upright position in front of the mirror. Adjust upright screen gradually so that a sharp image of the object is obtained at the screen. Note the difference in the positions. It gives the focal length of the concave mirror.

2) Place the fixed upright near the zero end of optical bench and the other two near the other end. Now clamp the holder with the mirror in the fixed upright keeping the mirror face towards the other end of the bench.

5) Take thin needle as the object \( o \) and mount it in the second upright. Move this upright and clamp it at a distance of about 1.5 times the rough focal length. The height of the object should be adjusted to make its top be along horizontal line through the pole of the mirror.

4) Repeat the above steps for image \( I \). The image needle should be think in the third upright.

5) Place the object \( o \) anywhere between \( F \) and \( C \) first, and then beyond \( C \). In the first case, the image will be
formed is real beyond C. The image is real, inverted and
magnified. In the second case, image formed is real
inverted and diminished and formed between F and
C. Adjust the heights of the objects and image
needles using cross movements of the upright to bring
the image of object needle in line with image needle.

(6) Note the positions of object needle, image needle and
mirror. Repeat the same, changing the positions of
the object needle.

RESULT:- the focal length of given concave mirror
calculation = 16.7 cm

PRECAUTIONS:-

1) the uprights should always be held vertically.
2) the pole of the concave mirror and tips of image and
object needles must lie on the same height.
3) the principal axis of the concave mirror must be
horizontal and parallel to the scale of the bench.
4) the parallax between object needle and image
needle must be removed tip to tip.
5) in order to locate position of the image, the eye
should be placed at least 30 cm away from needle.
Sources of error.

1) The uprights may not be vertical.
2) Markings on the optical bench may not be accurate.
3) Parallax removal may not be perfect.
[On L.H.S]

Concave mirror
<table>
<thead>
<tr>
<th>SL No</th>
<th>Position of the Mirror</th>
<th>Object</th>
<th>Image</th>
<th>Object distance (cm)</th>
<th>Image distance (cm)</th>
<th>Focal length (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>O</td>
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<td>33.6</td>
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<td>55</td>
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<tr>
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<td>O</td>
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<td>76</td>
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<td>76</td>
<td>16.5</td>
</tr>
</tbody>
</table>

Mean focal length = 16.7 cm