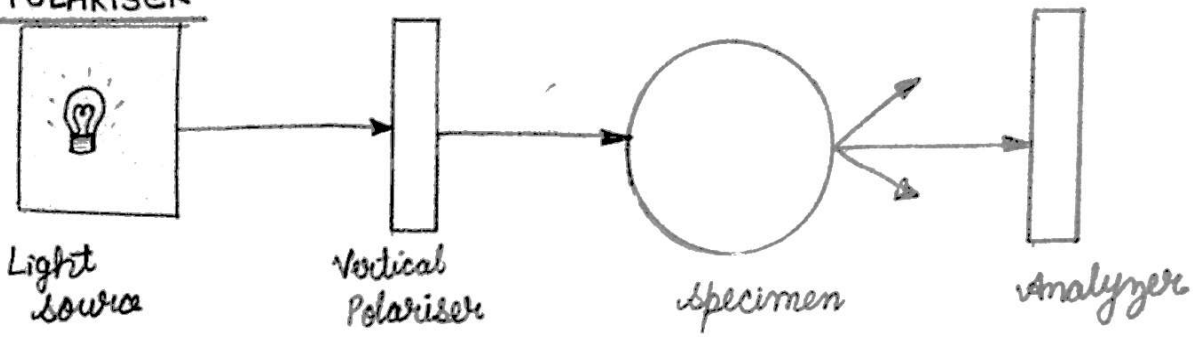
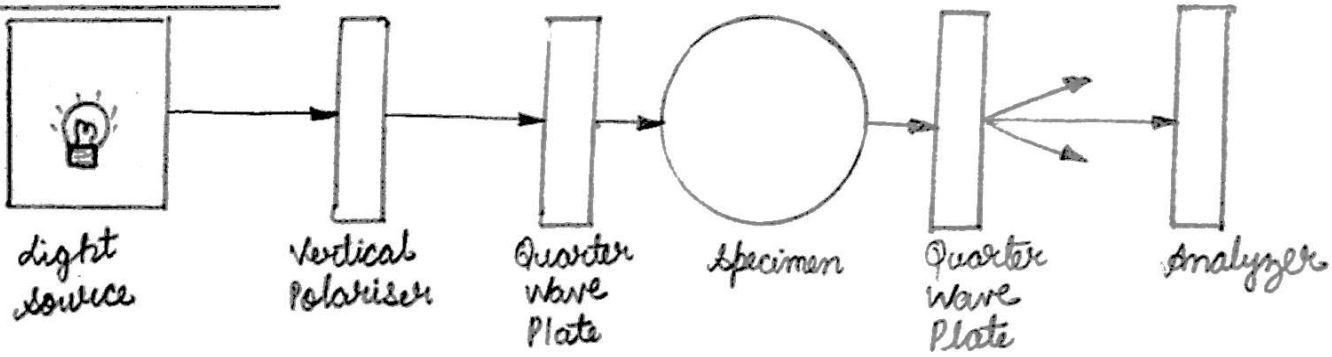
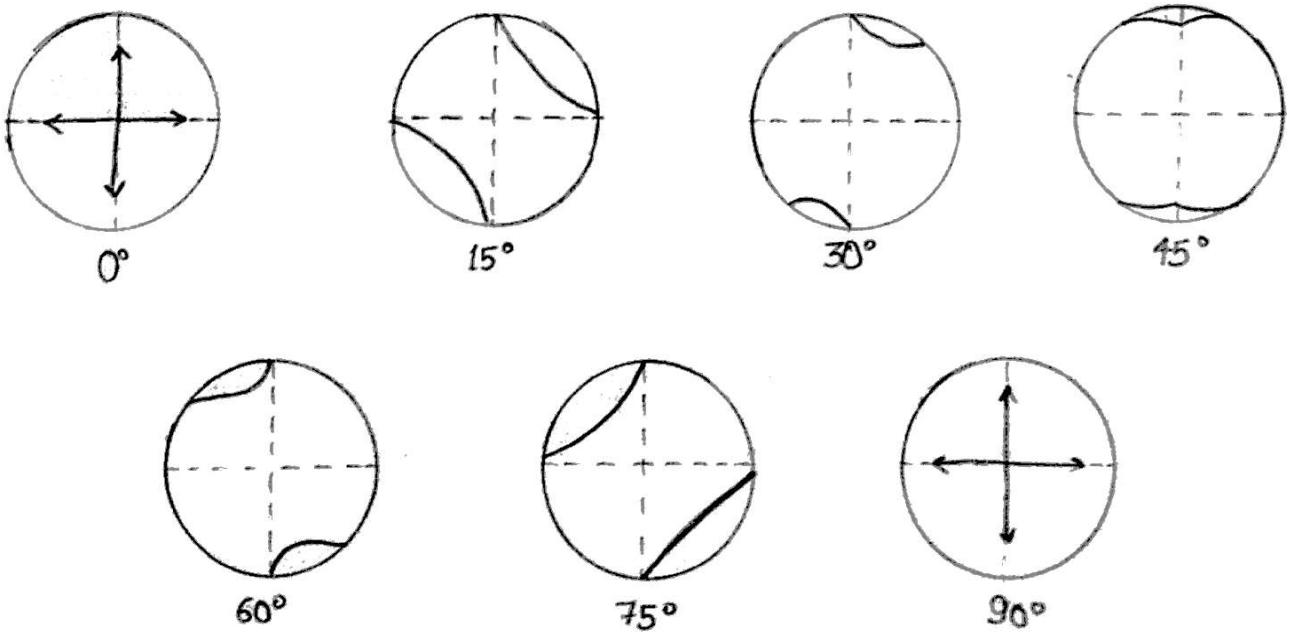
PLANE POLARISER



CIRCULAR POLARISER



ISOCLINIC FRINGES



DATE 29/9/16

EXPT. NO. 12

DETERMINATION OF PHOTO ELASTIC EXPERIMENT

- **Aim of the experiment:** To provide a qualitative, quantitative and visual observation of stress distribution in a loaded specimen using the principles of photoelasticity.

- **Apparatus:** (i) Polariser – Plane and circular
  (ii) Light source – Sodium (Monochromatic)
  Fluroscent (White light)
  (iii) Loading frame
  (iv) Analyzer
  (v) Epoxy resin specimen (Bifringer)

- **Theory:** Photoelasticity is a powerful experiment technology to provide a qualitative, quantitative and visual observation of the stress distribution in a loaded member. The study is based on change in photometric properties of some solids due to external load when white polarized light is passed through a bifringent model. Isoclinic fringe pattern are used to find stress trajectory. Tangent at any point on that trajectory gives the direction of principle stress. Isochromatic fringe pattern are used to find the magnitude of principle stresses.

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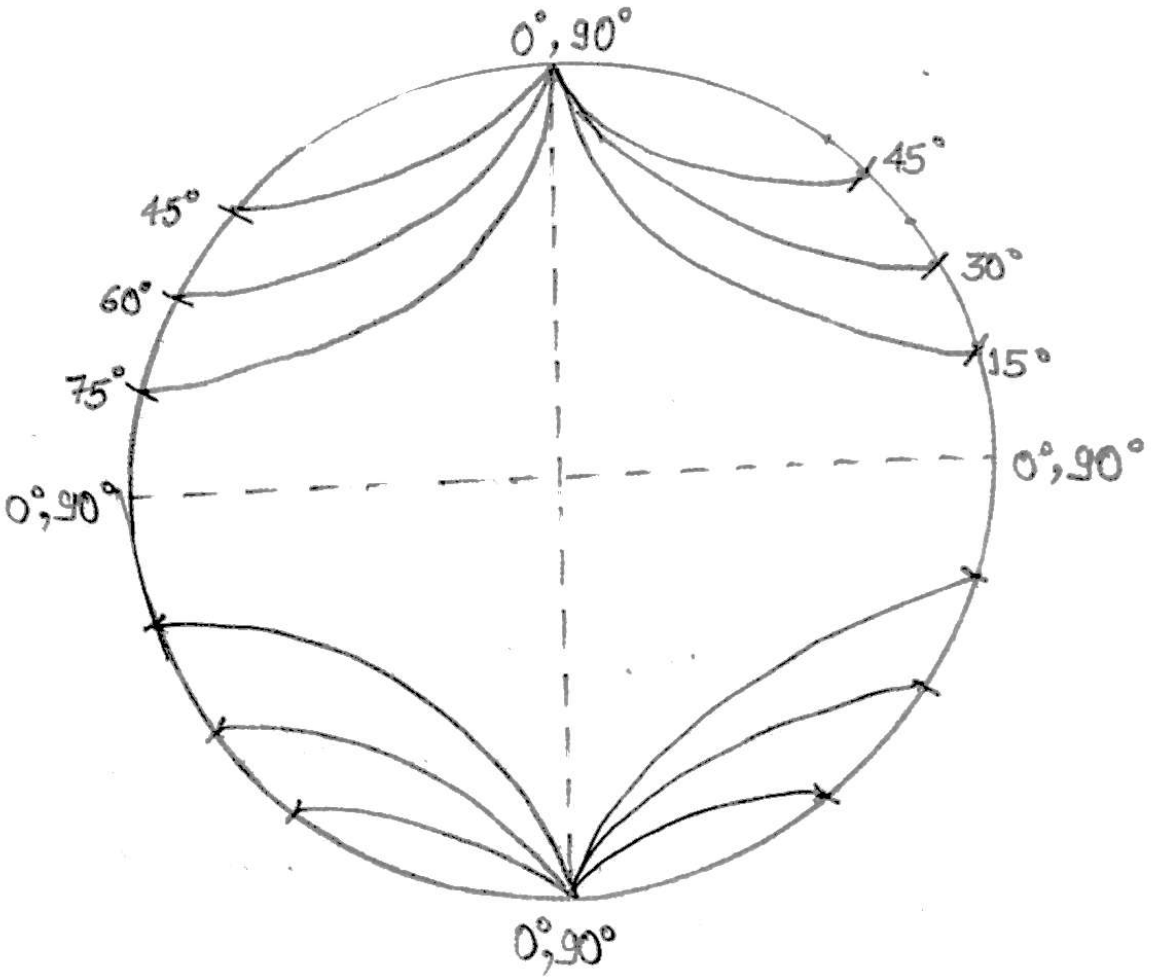

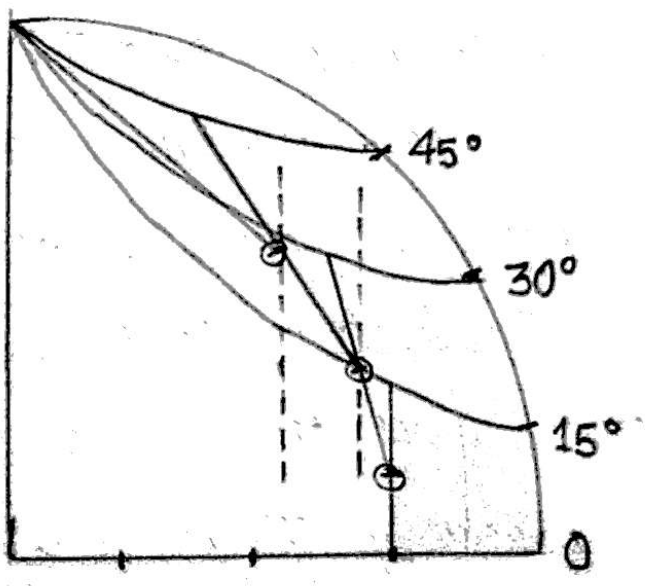

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EXPT. NO. 12

• Observation Table:

TABLE 1:

Sr No.	LOAD (P)	N
1	5 kg	0.62
2	7 kg	0.85
3	12 kg	1.4

now, $\boxed{\sigma_1 - \sigma_2 = \frac{Nf}{t}}$

where N = fringe order
f = fringe value
t = thickness of specimen

to find the value of f,

$$\sigma_1 - \sigma_2 = \frac{8P}{\pi D t} = \frac{Nf}{t} \Rightarrow \boxed{f = \frac{8}{\pi D}\left(\frac{P}{N}\right)}$$

Here,
D = 5 cm
t = 0.5 cm

TABLE 2:

Sr No.	x (cm)	fringe order(N)	$\sigma_1 - \sigma_2$
1	0	1.40	1.2547 MPa.
2	0.5	1.15	1.0306 MPa.
3	1.0	0.88	0.7887 MPa.
4	1.5	0.50	0.4481 MPa.
5	2.0	0.29	0.2599 MPa.
6	2.5	0	0 MPa.

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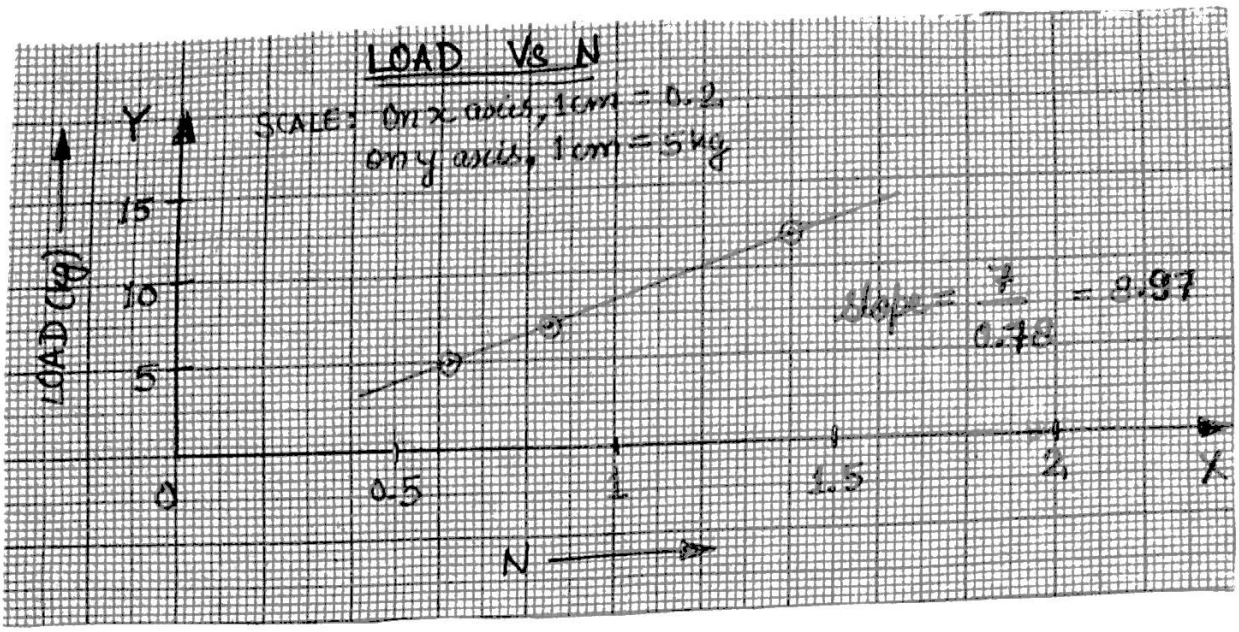

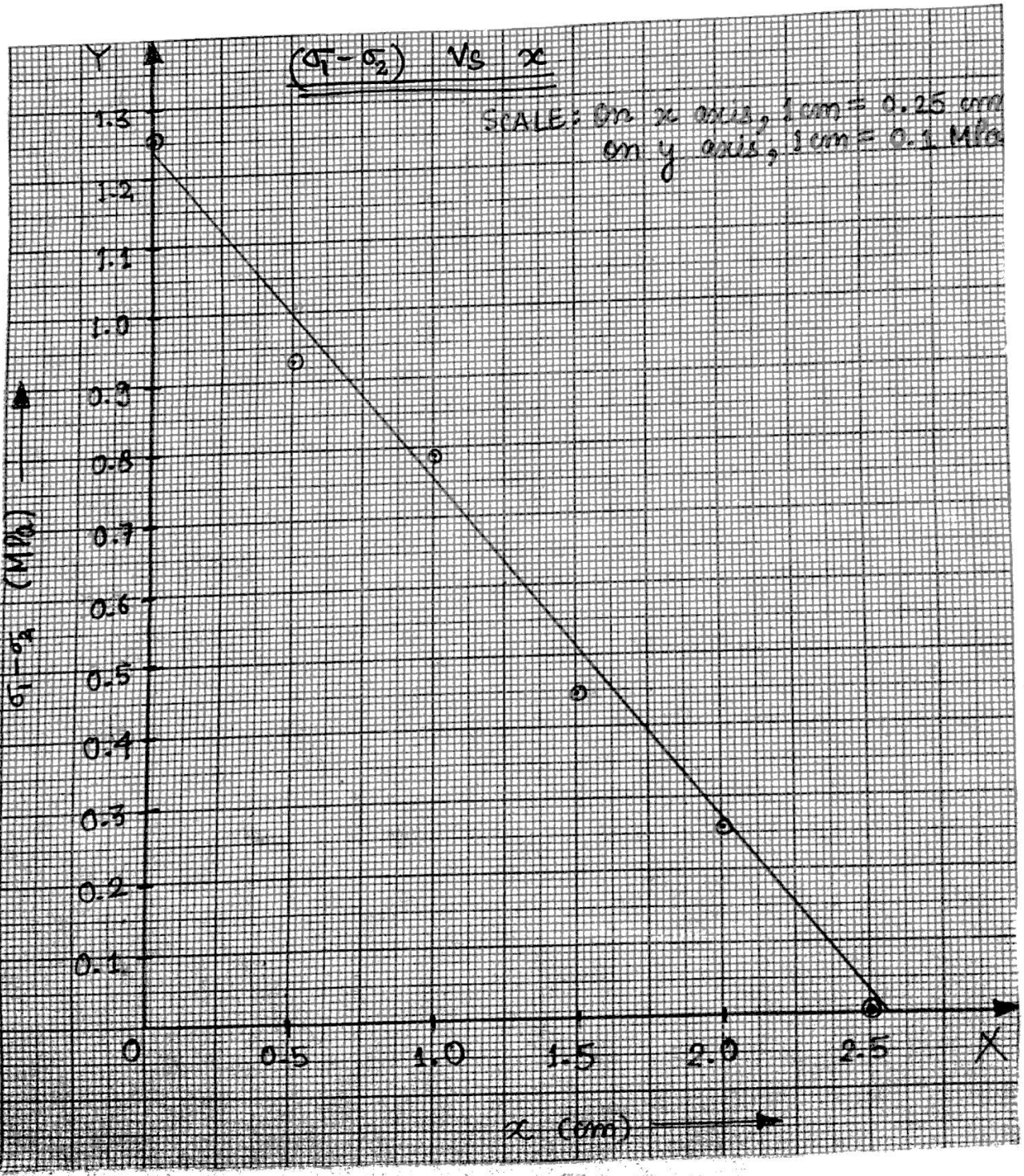

- **Calculations**

from graph 1, $\frac{P}{N} = 8.97 \text{ kgf} = 87.99 \text{ N}$

$$\therefore f = \frac{8}{\pi \times 0.05} \times 87.99 = 4481.293$$

$$\Rightarrow \boxed{f = 4481.293}$$

- **Result:**

The value of f as obtained from the graph is 4481.293

- **Discussions:**

➤ Photoelasticity is a very useful tool for engineers to see areas where a structure might break due to high concentration of stress.

➤ Photoelasticity is quite advantageous because it is

→ Quite and simple to use

→ Can be adapted in static as well as dynamic investigations

→ Unline analytical methods of stress determination, photoelasticity provides a more accurate determination of stress distribution, even in irregular materials.

→ only a small investment in equipment and materials is required for basic work.