PHYSICS

PAPER – 2

(PRACTICAL)

(Three hours)

*(Candidates are allowed additional 15 minutes for **only** reading the paper. They must **NOT** start writing during this time.)*

ALL ANSWERS MUST BE WRITTEN IN THE ANSWER BOOKLET PROVIDED SEPARATELY.

If squared paper is used, it must be attached to the answer booklet.

Marks are given for a clear record of observations actually made, for their suitability and accuracy, and for the use made of them.

*Statement of the theory, procedure of the experiment, apparatus, circuit diagrams, precautions are **not** required to be written unless specifically asked for.*

Candidates are advised to record their observations as soon as they have been made.

All working, including rough work, should be done on the same sheet as, and adjacent to, the rest of the answer.

Mathematical tables and squared paper are provided. The intended marks for questions or parts of questions are given in brackets [ ].

Answer **all** *questions.*

You should not spend more than one and a half hours on each question.

Question 1 **[12]**

This experiment determines the **focal length** of the given convex lens by **displacement method**.

You are provided with:

(a) A lens holder

(b) A convex lens

(c) Two optical pins

(d) An optical bench

Note: *The experiment may be performed on a table top, using a metre scale, in case an optical bench is not available.*

(i) Determine the approximate focal length f of the given convex lens by projecting the image of a distant object on a wall or a screen. Record the value of f in cm, correct upto **one decimal place**.

(ii) Now, arrange the object pin **O**, the image pin **I** and the lens **L** on the optical bench or table top as shown in ***Figure 1(a)*** so that the tips of **O** and **I** lie on the principal axis of the lens.

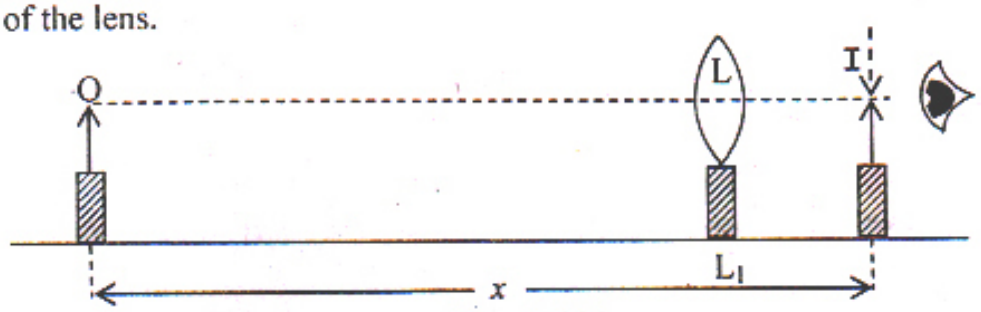

Figure 1(a)

(iii) Adjust the distance x between **O** and **I** to be **nearly** equal to $(4f + 10)$ cm. Ensure that this separation is maintained throughout this particular setting.

(iv) Move the lens towards the pin **I** and adjust its position until the diminished and inverted image of **O** coincides with the image pin **I**.

(v) Read and record the positions of **O**, $\mathbf{L_1}$ and **I** on the metre scale in cm, correct upto **one decimal place.**

(vi) Keeping **O** and **I** fixed, move the lens towards the object pin **O** and adjust its position as shown in ***Figure 1(b)*** until the magnified and inverted image of **O** coincides with **I**. Record the new position $\mathbf{L_2}$ of the lens.

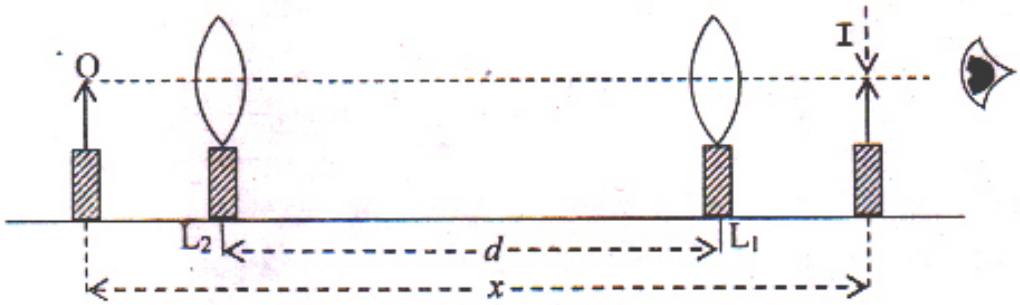

Figure 1(b)

(vii) The difference between the two positions L_1 and L_2 of the lens is the displacement d of the lens. Calculate and record the value of d, in cm, correct upto **one decimal place.**

(viii) Repeat the experiment to obtain **four more** sets of x and d, taking values of x in the range $(4f + 10)$ cm and 100 cm. Note that for each set, the positions of **O** and **I** are maintained constant and the parallax is removed by **moving the lens only.**

(ix) **Show the image position when the parallax has been removed, in any one of the readings in (viii) above, to the Visiting Examiner.**

(x) Tabulate all the **five sets** of values of x, x^2, d, d^2, and $y = (x^2 - d^2)/100$, along with their units given at each column head. Compute y up to **three significant figures.**

(xi) Plot a graph of y against x. Draw the line of best fit and determine its slope **S** using:

$$\mathbf{S} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{change\ in\ y}{change\ in\ x}$$

(xii) Calculate the focal length **F** of the given lens correct up to **one decimal place**, using: $F = 25\ S$.

(xiii) Record the value of **F** in your answer booklet.

Question 2 **[6+2]**

A. This experiment determines the **resistivity** of the material of the given wire.

You are provided with a 100 cm long uniform metallic wire **AB** stretched along a metre scale and provided with terminals at both ends.

You are also provided with a resistance box **R.B.**, a voltmeter of range 0-3V, an ammeter of range 0 - 1A, a 4V dc power supply '**E**', a plug key '**K**', a jockey '**J**' and a few connecting wires.

(i) Determine and record the **least count** of the given voltmeter and the ammeter with proper units in your answer booklet.

(ii) Set up a circuit as shown in ***Figure 2*** below. Make sure that all connections are tight.

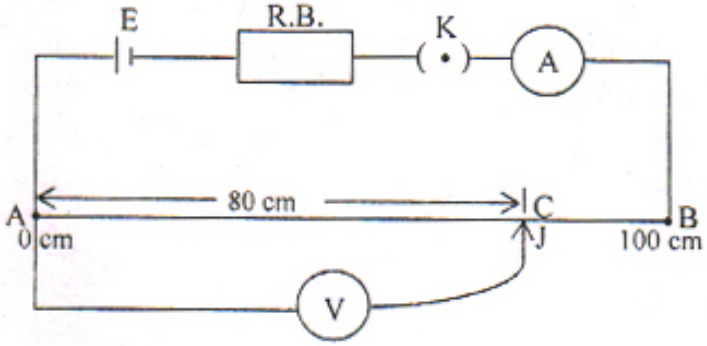

Figure 2

(iii) Take out 1Ω plug from the resistance box R.B. so that R = 1Ω. Ensure that all other plugs are tightly closed. Place the jockey **J** at a point **C** on the wire AB, such that AC=80 cm. The reading of the voltmeter as well as the ammeter must be **within its range**. Read and record the readings of the voltmeter and the ammeter, i.e. **V** and **I**, with proper units.

(iv) Repeat the experiment to obtain **four more** sets of readings of **R, V** and **I** by increasing the resistance **R** by 1Ω each time. Ensure that the jockey is **always** kept at the **same position C** such that AC = 80 cm in **all five sets** of readings.

(v) **Show any one of the readings in (iv) above, to the Visiting Examiner.**

(vi) Determine the value of resistance r using:

$$r = \frac{V}{I}$$

for each set, correct **upto three significant figures.**

(vii) Now, tabulate all the **five sets** of values of **R, V, I** and **r** with proper units.

(viii) Find r_o, the mean of all the five values of r and record its value in your answer booklet.

B. (i) Determine and record the least count of the given **micrometer screw gauge** in **cm**.

(ii) Using it, calculate the diameter 'd' of the given specimen wire 'X' and record its value in **cm** in your answer booklet.

(iii) Calculate the **resistivity** ρ of the material of the wire, using the formula:

$$\rho = \frac{\pi d^2}{320} r_o$$

Question 3

Show the following to the Visiting Examiner for assessment:

Project [7]

Physics Practical File. [3]