Question 1

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

(i) Determine the approximate focal length $f_1$ of the given convex lens (marked M) by projecting the image of a distant object on a wall or a screen. Record the value of $f_1$ in cm, correct up to one decimal place.

![Figure 1 (a)](image-url)
(ii) Arrange the object pin O, the image pin I and the lens M on an 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.

(iii) Adjust the distance $x$ between O and I to be equal to 70 cm. Ensure that this separation is maintained throughout this particular set up.

(iv) Move the convex lens towards the image 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, M₁ and I on the meter scale in cm, correct up to one decimal place.

![Figure 1(b)](image)

(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 without parallax. Record the new position M₂ of the lens.

(vii) The difference between the two positions M₁ and M₂ of the convex lens is the displacement ‘$d$’ of the lens. Calculate and record the value of $d$, in cm, correct up to 1 decimal place.

(viii) Repeat the experiment to obtain four more sets of $x$ and $d$ where the range of $x$ is between 70 cm and 100 cm.

(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 the five sets of values of $x$, $x^2$, $d$, $d^2$ and $y = \frac{x^2 - d^2}{40}$, 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 $S = \frac{\Delta y}{\Delta x} = \text{change in } y/\text{change in } x$.

(xii) Calculate the focal length $f$ of the given lens correct up to one decimal place, using $f = 10 \times S$.

(xiii) Record the value of $f$ in the answer book, with proper unit.
Question 2

A. This experiment determines resistance of a piece of metallic wire.

You are provided with one-metre long wire AB attached to a metre scale with terminals at the two ends. You are also provided with a resistance box RB, a coiled resistor ‘r’ with terminals, a jockey ‘J’, a two-volt dc power supply ‘ε’, a plug key ‘K’, a zero centre galvanometer and a few connecting wires.

(i) Set up a circuit as shown in Figure 2 below. Ensure that all connections are right and tight.

(ii) Take out a 2 ohm plug from the resistance box RB so that \( R = 2 \). Press the jockey J gently on the wire AB, to obtain the null point D (galvanometer shows no deflection). Record \( l = AD \) in cm.

(iii) Repeat the experiment for four more values of \( R \) in the range 2 to 10, and obtain corresponding values of \( l \).

(iv) Show any one of the readings in (iii) above to the Visiting Examiner.

(v) Tabulate \( R \) and \( l \) with units given at the column head.

(vi) For each value of \( R \), calculate \( r = R \left( \frac{100 - l}{l} \right) \) up to three significant figures.

(vii) Calculate the mean value of ‘r’, and record its value in your answer book with proper unit.

B. (i) Determine the least count of the given screw gauge in millimetre and the diameter ‘d’ of the given specimen wire.

(ii) Calculate specific resistance ‘\( \rho \)’ of the material of the wire using \( \rho = 2.5 \times 10^{-7} \pi r d^2 \) and record its value, in your answer booklet.

Question 3

Show the following to the Visiting Examiner for assessment:

(a) Project Report [7]

(b) Physics Practical File. [3]