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PREFACE

Physics is the study of matter and energy and the interaction between them. It reveals the magic behind the wonderful existence of natural phenomenon. Hi-tech gadgets, modern machinery, gigantic skyscrapers, speedy trains, superior infrastructure are some of the marvels of physics. Practical physics has laid the groundwork in the fields of engineering, technology and medical diagnostics. In practical physics the student obtain laboratory skills, design experiments and apply instrumentation such as electronic circuits to observe and measure natural phenomena.

To master the science of physics practical one needs to have a complete and thorough knowledge of all the experiments. Hence we bring to you **"Std. XII Sci. : PHYSICS PRACTICAL HANDBOOK"** a handbook which covers all the experiments of Std. XII. This handbook written according to the needs and requirement of the board exam helps the student to score high. It includes different sets of experiments with proper steps and neat and labeled diagrams. These experiments help the student to understand the practical applications of many principles and laws involved in Std. XII. The handbook also includes all the useful tables given at the end.

And lastly, we would like to thank all those who have helped us in preparing this book. There is always room for improvement and hence we welcome all suggestions and regret any errors that may have occurred in the making of this book.

A book affects eternity; one can never tell where its influence stops.

Best of luck to all the aspirants!

Your's faithfully

Publisher

SYLLABUS

List of Practicals

1. To determine Young's modulus of elasticity of the material of a given wire.
2. To find the force constant and effective mass of helical spring by plotting T^2 --m graph using method of oscillations.
3. To determine the surface tension of water by capillary rise method.
4. To study the relationship between the temperature of a hot body and time by plotting a cooling curve.
5. To study the relation between frequency and length of a given wire under constant tension using sonometer.
6. To study the relation between the length of a given wire and tension for constant frequency using sonometer.
7. To find the speed of sound in air at room temperature using a resonance tube.
8. To find resistance of given wire using metre bridge and hence determine the specific resistance of its material.
9. To verify the laws of combination (series/parallel) of resistance using a metre bridge.
10. To compare the emf of two given cells using potentiometer.
11. To determine the internal resistance of given cell using potentiometer.
12. To determine resistance of galvanometer using metre bridge.
13. To draw the I-V characteristic curves of a p-n junction diode in forward bias and reverse bias.
14. To study the characteristics of common-emitter npn or pnp transistor and to find out the values of current and voltage gains.
15. To draw the characteristic curve of a zener diode and to determine its reverse break down voltage.

List of Activities

1. To study dissipation of energy of a simple pendulum by plotting a graph between square of amplitude and time.

2. To study the effect of detergent on surface tension by observing capillary rise.

3. To study the factor affecting the rate of loss of heat of a liquid.

4. To study effect of load on depression of a suitably clamped meter scale loaded (i) as its end (ii) in the middle.

5. To measure the resistance and impedance of an inductor with or without iron core.

6. To study the variation in potential drop with length of a wire for a steady current.

7. To draw the diagram of a given open circuit comprising at least a battery, resistor/rheostat, key, ammeter and voltmeter. Mark the components that are nor connected in proper order the correct the circuit and also the circuit diagram.

8. To study effect of intensity of light (by varying distance of the source) on an L.D.R.

9. To identify a diode, an LED, a transistor, and 1C, a resistor and a capacitor from mixed collection of such items.

10. Use of multimeter to (i) identify base of transistor (ii) distinguish between npn and pnp type transistors, (iii) see the unidirectional flow of current in case of a diode and an LED (iv) check whether a given electronic component (e.g. diode, transistor or IC) is in working order.

11. To observe polarization of light using two polaroids.

12. To assemble a household circuit comprising three bulbs, three (on/off) switches, a fuse and a power source.

GROUP - A

01 Young's Modulus 'Y' By Searle's Method

EXPERIMENT

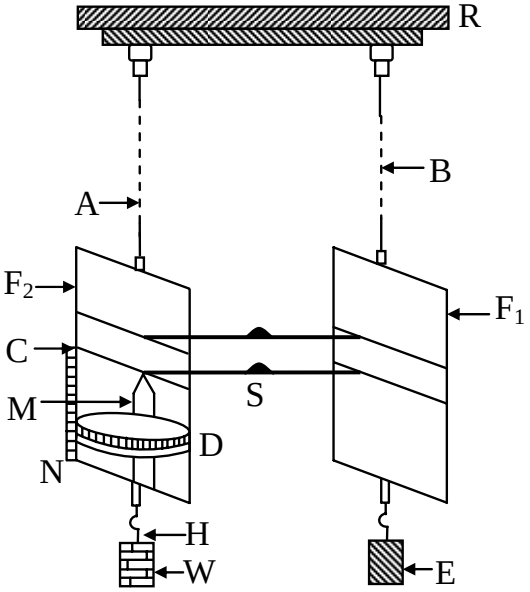
Aim:

To determine Young's modulus of elasticity of the material of a given wire by Searle's method.

Apparatus:

Two long (nearly 2 m or more) identical wires of the same material and diameter, Searle's apparatus, micrometer screw gauge, slotted weights each of 500 g, metre scale, etc.

Diagram:



R – Rigid support
A, B – Wires of same material and diameter
F_1, F_2 – Metal frames
S – Spirit level
M – Micrometer screw
D – Circular disc
C – Support for screw
E – Dead load
H – Hanger to which the weights (W) are attached
N – Main scale

Formula:

$$Y = \frac{MgL}{\pi r^2 e} = \frac{gL}{\pi r^2}\left(\frac{M}{e}\right)$$

$[\pi = 3.142]$

$$Y = \frac{gL}{\pi r^2} \cdot \left(\frac{1}{\text{Slope}}\right)$$

Where, Y = Young's modulus of the material of wire
M = Mass suspended from experimental wire
g = Acceleration due to gravity
L = Original length of experimental wire
r = Radius of the experimental wire
e = Extension produced in wire.

Procedure:

i. Arrange the experimental set up as shown in diagram. Attach a zero load (slotted hanger it self) and dead load (E) to the frames of the experimental wire and dummy wire respectively so that the wires become free of kinks and remain vertically straight.

ii. With the help of micrometer screw gauge, find the correct diameter of the wire at three different places. At every place two readings of the micrometer are taken while holding it in one position and another perpendicular to it by rotating through 90°.

iii. In all, six readings of the diameter of the wire are taken. Hence mean diameter and radius of the wire is found out.

iv. Adjust the spirit level so that the air bubble is at the centre. Note down the reading of the micrometer screw (M) attached to it. This is zero reading. (This contains main scale reading and circular scale reading.)

v. Using a meter scale measure the length L of the experimental wire (A) from the point of suspension to the point fixed on the frame.

vi. Add half kg weight to experimental wire, wait for two minutes. Bring the air bubble in the Spirit level at the centre. Note the main scale and circular scale reading of the micrometer (M) of searle's apparatus.

Repeat the above procedure, each time by adding half kg weight to the hanger.

vii. Take six readings for six different weights. Care should be taken that elastic limit is not crossed.

viii. Decrease the load in same steps of half kg weight and note the corresponding reading for a given load for unloading. Find the mean of the two readings corresponding to loading and unloading.

ix. Find the extension (elongation) produced in the wire for every load.

Observations:

i. L.C. of micrometer (M) attached to Searle's apparatus, No. of divisions on circular scale

N = 100, pitch (P) = $\frac{x}{5} = \frac{0.5\text{ cm}}{5} = 0.1$ cm

L.C. = $\frac{P}{N} = \frac{0.1\text{ cm}}{100} = 0.001$ cm

ii. L.C. of micrometer for diameter of wire, No. of divisions on circular scale = N = 100

Pitch (P) = $\frac{x}{5} = \frac{0.5\text{ cm}}{5} = 0.1$ cm

L.C. = $\frac{P}{N} = \frac{0.1\text{ cm}}{100} = 0.001$ cm

Zero error of micrometer = Z = ± ….. cm

iii. Original length of the experimental wire (A) = L = …. cm

Observation table:

i. For radius of the wire:

Obs. No	M.S.R a (cm)	C.S.D b	C.S.R c = b × L.C.	T.R a + c (cm)	Corrected diameter d = (a + c) – Z (cm)
1.					
2.					
3.					
4.					
5.					
6.					

Mean corrected diameter = d = …… cm

$\therefore$ Radius = r = $\frac{d}{2}$ = ….. cm

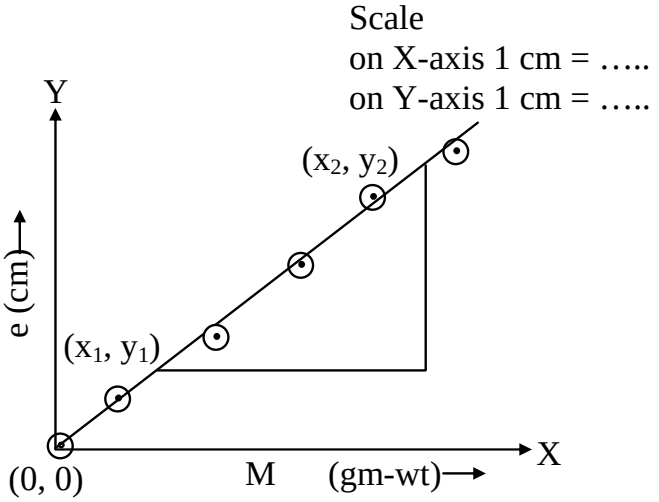
ii. For extension of wire:

Obs. No.	Load M (gm-wt)	Loading				Unloading				Mean reading 'a' (cm)	Extension for each load e (cm)	Extension for 1000 gm-wt e′ (cm)
		M.S.R x (cm)	C.S.D. n	C.S.R y = n×L.C (cm)	T.R. x + y (cm)	M.S.R. x (cm)	C.S.D n	C.S.R n × L.C = y (cm)	T.R. x+ y (cm)			
1.	0									a_o =	$a_0 - a_0$ =	
2.	500									a_1 =	$a_1 - a_0$ =	$a_2 - a_0$ =
3.	1000									a_2 =	$a_2 - a_0$ =	$a_3 - a_1$ =
4.	1500									a_3 =	$a_3 - a_0$ =	$a_4 - a_2$ =
5.	2000									a_4 =	$a_4 - a_0$ =	$a_5 - a_3$ =
6.	2500									a_5 =	$a_5 - a_0$ =	

Mean extension e′ = …… cm

Graph:

The graph of extension 'e' against load 'M' is plotted with (0, 0) origin.



$$\text{Slope} = \frac{y_2 - y_1}{x_2 - x_1}$$

$$\therefore \quad \frac{1}{\text{slope}} = \frac{x_2 - x_1}{y_2 - y_1}$$

Calculations:

i. $Y = \frac{gL}{\pi r^2} \times \frac{1000}{e'}$

ii. $Y = \frac{gL}{\pi r^2} \left(\frac{1}{\text{slope}} \right)$

Result:

i. Young's modulus of the material of the wire (by calculation) = …..dyne/cm^2

ii. Young's modulus of the material of the wire (by graph) = ……dyne/cm^2

Precautions:

i. Measure the diameter of the wire accurately.

ii. Rotate the circular scale of Searle's apparatus in one direction for loading and in opposite direction for unloading to avoid error due to backlash.

iii. Readings of loading and unloading should be taken within elastic limit.

iv. Once the wire is loaded or unloaded wait for complete extension of the wire.

Space for calculation: