



Manonmaniam Sundaranar University, Directorate of Distance & Continuing Education, Tirunelveli

**Manonmaniam Sundaranar University,
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OPEN AND DISTANCE LEARNING(ODL) PROGRAMMES
(FOR THOSE WHO JOINED THE PROGRAMMES FROM THE ACADEMIC YEAR 2023–2024)

**III YEAR
B.Sc. Physics
Course Material
Physics Practical -V (JMPHP5)
General Physics Experiments-I**

*Prepared
By*



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PRACTICAL V

GENERAL PHYSICS EXPERIMENTS

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1.POTENTIOMETER- CALIBRATION OF HIGH RANGE VOLTMETER

Aim:

To calibrate a high range voltmeter using potentiometer.

Apparatus Required:

High range voltmeter, Potentiometer, Standard cell (e.g., Daniel cell with emf about 1.08 V), Accumulators or DC power supply, Rheostats, Resistance boxes, plug keys and six-way key Galvanometer, Connecting wires.

Formula:

$$V = \frac{(P+Q)}{P} * \frac{E}{L} * l$$

Where,

- l is the balancing length obtained for the divided potential,
- L is the balancing length for the standard cell E ,
- V is the actual voltage to be compared to the voltmeter reading
- E is the emf of the Daniel cell.
- P and Q are resistance of the potentiometer.

Theory:

The potentiometer is used to accurately measure the potential difference applied across the voltmeter to check and correct its reading. First, the potentiometer is standardized using the balancing length L for the standard cell (Daniel cell of known emf E), allowing one to determine the potential gradient along the wire:

$$\text{Potential gradient: } k = \frac{E}{L}$$

For measuring high voltages, a voltage divider circuit using resistances P and Q is used, since the potentiometer itself cannot directly measure high voltage across the voltmeter. The potential difference across P (which is within the measurable range) is related to the actual voltage (V) across the voltmeter by:

$$V = E \cdot \frac{(P + Q)}{P} \cdot \frac{l}{L}$$

Circuit diagram:

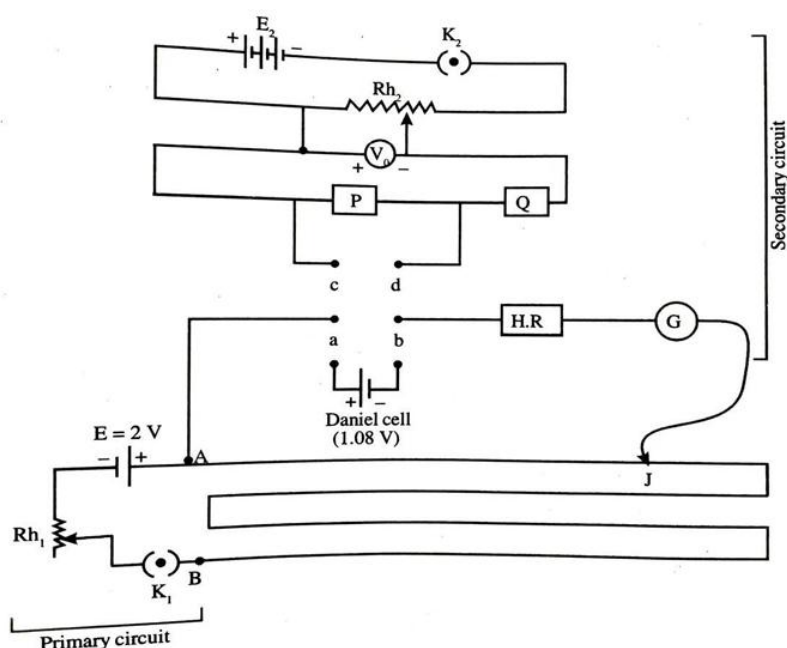


Figure 1.1 potentiometer calibration of voltmeter.

Procedure:

1. Set up the circuit with the potentiometer wire, standard cell, rheostat, and the voltmeter connected via the voltage divider resistors P and Q .
2. Standardize the potentiometer wire by balancing the known emf of the standard cell and note the balancing length L .
3. Adjust the rheostat and the plug key arrangement to set the voltmeter on full scale deflection.
4. Slide the jockey along the potentiometer wire to find the balancing length l for the voltage across P in the divider.
5. Record the voltmeter reading V_0 along with the balancing length l .
6. Calculate the actual voltage using

$$V = E \times \frac{(P + Q)}{P} \times \frac{l}{L}$$

where E is the emf of the standard cell.

7. Repeat the readings for different ranges of the voltmeter to cover its entire scale.



8. Plot a graph of voltmeter reading V_0 versus the actual voltage V to obtain the calibration curve and determine errors.

Observations:

Emf of the Daniel cell = 1.08 V

S.No	Voltmeter Reading V_0 (volt)	Balancing length l (10^{-2} cm)	$V = \frac{(P+Q)}{P} * \frac{E}{L} * l$ (volt)	Resistance (ohm)	
				P	Q
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					

Model graph:

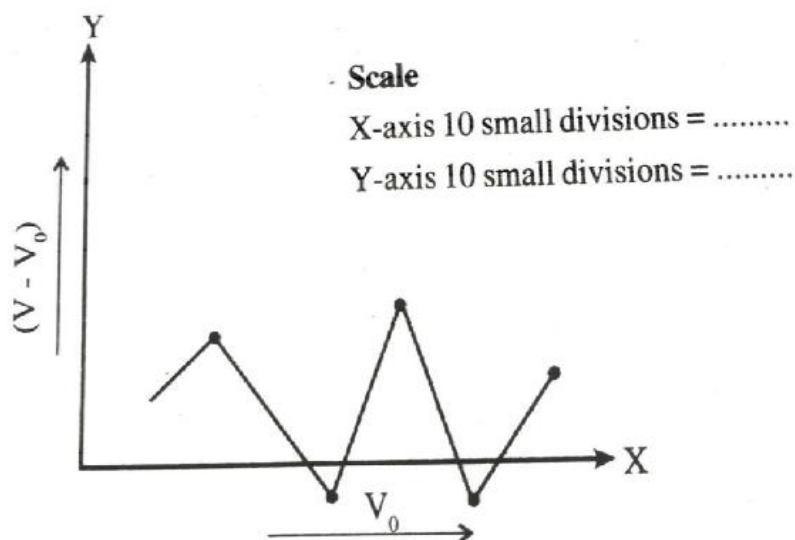


Figure 1.2 model graph V vs $V-V_0$

Result:

The given high range voltmeter has been calibrated for different voltmeter reading on it and the calibration graph is drawn.



2.SPECTROMETER-DIFFRACTION GRATING BY NORMAL INCIDENCE METHOD, MEASUREMENT OF WAVELENGTH OF MERCURY SPECTRAL LINES

Aim:

To determine the wavelength of mercury spectral lines using grating by normal incidence method.

Apparatus required:

Mercury lamp, spectrometer, plane transmission grating, reading lens and spirit level.

Formula:

$$\lambda = \frac{\sin \theta}{nN} \text{ (m)}$$

Where,

λ is the wavelength of spectral lines

θ is angle of diffraction.

N is lines per inch of the grating

n is order of the spectrum.

Principle:

When a wave strikes an obstacle, the light ray will bend at the corners and edges of it, which causes the spreading of light waves into the geometrical shadow of the obstacle. The phenomenon is termed as diffraction.

Procedure:

i) Adjustment of the collimator and the telescope

- Level the prism table, telescope and collimator with spirit level such that telescope axis and collimator axis intersect that the principal vertical axis of the spectrometer A prism may be used for this purpose.
- Focus the eyepiece of the telescope on the cross wire by drawing it in or out of the telescope tube until the cross wire is seen closely.
- Use Schuster's method for focusing telescope and collimator for parallel rays.

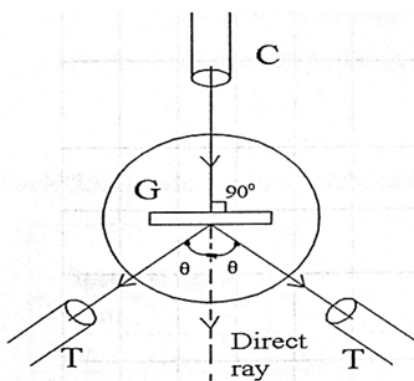


(ii) Adjustment of the grating

- The grating is to be adjusted on the prism table such that light from the collimator falls normally on it for achieving this.
- First the collimator and the telescope are brought in one line and the image of the slit is focused on the vertical crosswire. The corresponding reading on both the Vernier is noted.
- The telescope is rotated through 90 deg
- Mount the grating on the prism table and rotate the prism table, so that the reflected image is seen on the vertical crosswire in the telescope. Take the vernier readings.
- Turn the prism table from this position through 45 deg or 135 deg so that writing on the grating is away from the collimator. In this position grating is normal to the incident beam.
- The slit is rotated in its plane till the spectral lines are very sharp and bright. This brings the slit parallel to the linear of grating.

(iii) Measuring the diffraction angles

- Rotate the telescope to the left side of the direct image and adjust it on different spectral lines starting with first order blue lines and finishing with second order yellow lines, turn by turn. It should be taken care that the movement of telescope is in one direction.
- Note the vernier readings V1 and V2
- Now, rotate the telescope to the right side of the direct image and repeat steps. The difference of corresponding vernier readings with given twice of the angle of diffraction.
- Find angle of diffraction for prominent lines in the first and the second order spectra.



C → Collimator; G → Grating table;
T → Telescope; θ → Angle of diffraction

Figure 1: spectrometer grating

Table 1: To determine the wave length of various spectral lines.

Spectral lines	Reading of the diffracting image												Difference between two reading	Mean 20	Mean of angle of diffraction n θ	λ × 10 ⁻¹⁰ m λ = $\frac{\sin \theta}{nN}$
	Left						Right									
	A ₁			B ₁			A ₂			B ₂						
	MS R	V R	TR	MSR	VR	TR	MSR	VR	TR	MSR	VR	TR	A ₁ ~A ₂	B ₁ ~B ₂		
Violet																
Blue																
Bluish green																
Green																
Yellow-1																
Yellow-2																
Orange																
Red																



Table 2: Wavelength of various spectral lines.

Colour	Common wavelength (10^{-10} m)	Experimental wavelength (10^{-10} m)
Violet	3800-4200	
Blue	4500-4900	
Green	4900-5700	
Yellow	5700-5900	
Orange	5900-6300	
Red	6300-7500	

Calculations:

1.No of lines per inch of the grating(N):

$$n=1, \quad \lambda \text{ for green is } 5461 \times 10^{-10} \text{ m}$$

$$N = \sin \theta / \lambda \quad \text{lines/m}$$

2.Wavelength of various spectral lines

$$\lambda = \frac{\sin \theta}{nN} \quad (m)$$

Result:

The wavelength of the spectral lines are determined and the values are tabulated.



3. SPECTROMETER I-D CURVE

Aim:

To draw a curve connecting the angle of incidence and the angle of deviation in a prism I-D curve using a spectrometer and to calculate the refractive index of the prism.

Apparatus required:

Spectrometer, prism, sodium vapour lamp, etc.

Formula:

$$\mu = \sin((A + D) / 2) / (\sin A / 2)$$

Where, μ – Refractive index of the prism

A – Angle of the prism is 60 deg

D – Angle of minimum deviation

Principle:

When a beam of light strikes on the surface of transparent material (glass, water, quartz crystal, etc.,) the position of the light is transmitted and other portion is reflected. The transmitted light ray has small deviation of the path from the incident angle.

Procedure:

- After the preliminary adjustment of the spectrometer, telescope is focused directly to see the image of the slit by working on the tangential screw, vertical cross wire is made to coincide with the fixed edge of the image of the slit.
- At this position, the telescope is clamped rigidly.
- Two verniers are then fixed firmly to read 0° and 180° .
- So that throughout the experiment, the direct reading of the verniers remain same.
- Next, the prism abc is mounted as shown in figure, with its base be almost parallel to the axis of the collimator.
- Now to set the prism, so that a ray of light from collimator falls on the refracting face ab with a particular angle of incidence i , the telescope from its direct position is rotated towards ab through an angle $\theta = 180 - 2i$ and it is fixed in that position by using the radial screw.
- The prism is adjusted by slowly rotating the plate till the fixed angle of the reflected image of the slit from the light ray incident on ab at angle i to the normal at the point of the incidence.

- The telescope is released and now turned towards the base to observe the refracted image from the face ac.
- Finally adjusting the position of the telescope, the vertical axis cross wire is made to coincide with the same fixed edge of the image.
- The readings of the vernier v_1 and v_2 are noted.
- The difference with the direct reading gives angle of deviation d for the given angle of incidence.
- The experiment is performed for various angles the readings of the verniers corresponding to respective refracted rays are tabled as given in table.

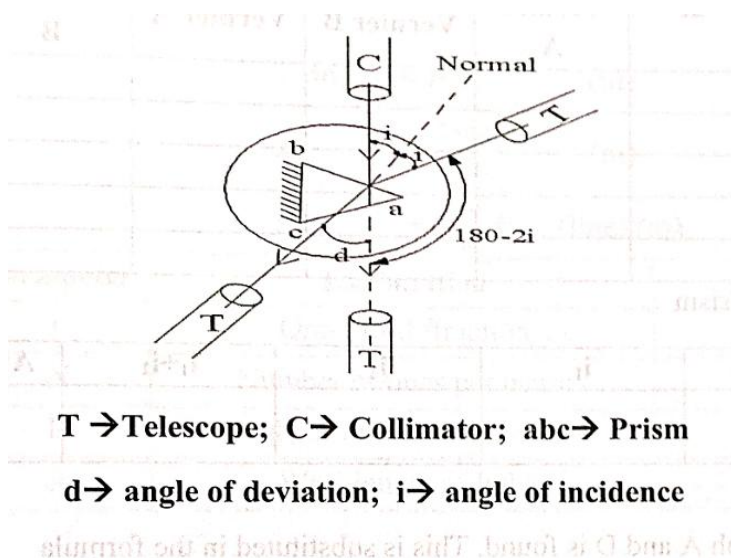


Figure 2: angle of minimum deviation

Model graph

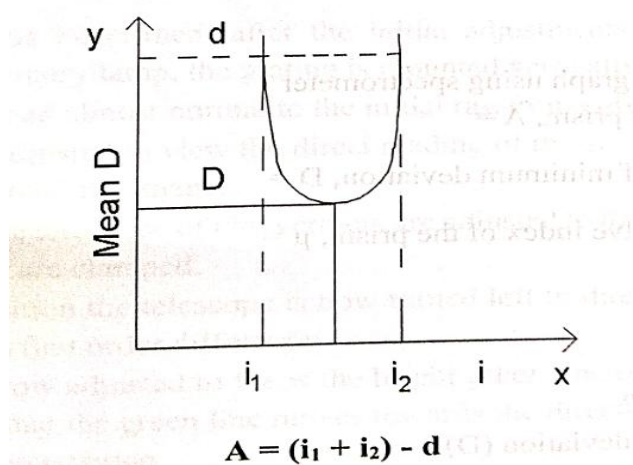


Figure 3.2: model graph of I-D graph



Table 1: To find the angle of minimum deviation

LC= 1MSD - 1VSD

LC=1'

Angle of incidence	180-2i	Reading corresponding to refracted image		Angle of deviation		Mean D
		Vernier A	Vernier B	Vernier A	Vernier B	
40						
50						
60						
70						
80						

Table 2: Angle of Prism

D	i ₁	i ₂	i ₁ +i ₂	A=(i ₁ +i ₂ -d)

Calculation:

From the graph A and D is found. This is substituted in the formula

$$\mu = \sin((A + D) / 2) / (\sin A / 2)$$

Result:

From the I-D curve graph using spectrometer

1. Angle of prism, A=
2. Angle of minimum deviation, D=
3. Refractive index of the prism, μ =



4.DETERMINATION OF YOUNG'S MODULUS BY ELLIPTICAL FRINGES METHOD

Aim:

To determine the Young's modulus Y of a material in the form of a rectangular beam by using the elliptical fringes (Newton's rings) method in an optical interference setup.

Apparatus required:

Optical lever or interference setup with microscope, Monochromatic light source (e.g., sodium vapor lamp, $\lambda = 5893 \text{ \AA}$), optically plane glass plate, Loading hanger and weights, vernier caliper, screw gauge, Reading microscope with micrometer screw, Knife edges or support frame and Travelling microscope.

Formula:

$$\text{Youngs Modulus } Y = \frac{3Wl^3}{2bt^3\delta}$$

Where, W = load applied (in newtons)
 l = Distance between knife edges (in m)
 b = Breadth of the beam (in m)
 t = Thickness of the beam (in m)
 δ = depression at the centre (in m).

The depression δ can be calculated from the fringe displacement (x) corresponding to a known number of fringes (n) using:

$$\delta = \frac{n\lambda}{2}$$

Theory:

When a rectangular beam supported at its ends is loaded at the center, it bends slightly due to the applied load. The upper surface is compressed and the lower surface is stretched, producing a difference in path of light rays reflected from the top and bottom surfaces.

When monochromatic light is reflected normally from these two surfaces and observed through a microscope, elliptical interference fringes are seen. The change in fringe pattern with different loads is related to the curvature produced, which depends on the Young's modulus (Y) of the material.

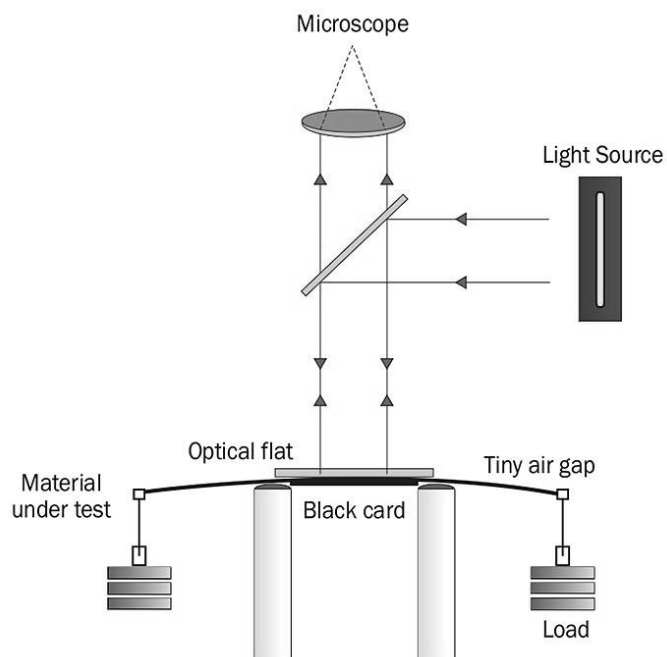


Figure 3.1 : Young's modulus by elliptical fringes

Procedure:

- Arrange the apparatus with the beam supported on knife edges and the loading hanger at the center.
- Illuminate the beam with monochromatic light and adjust the microscope to focus on the interference fringes.
- Observe and record the initial position of the central fringe without any load.
- Add a known load W to the hanger and note the displacement of the central fringe (number of fringes shifted, n).
- Increase the load step by step and record n for each load.
- Remove loads one by one and check for elastic recovery (fringes return to same position).
- Measure dimensions of the beam (l, b, t).
- Using the formula, calculate Y for each load and find the mean value.



Observations:

Table 1 : Depression and Young's modulus of the glass material

S.no	Load W (N)	Number of fringes shifted n	Depression $\delta = n \lambda / 2$ (m)	Youngs Modulus Y (N/m ²)
1				
2				
3				
4				
5				
6				

Table 2: Determination of breadth of the glass bar using vernier calliper.

L.C= 0.01 cm

Zero Error=

S. No	MSR (cm)	VSC	VSR (cm)	TR (cm)	Correct Reading CR(cm)
1					
2					
3					
4					
5					

Table 3: Determination of the width of the glass bar using screw gauge.

L.C= 0.01 mm

Z.E= div

Z.C= mm

S. No	PSR (mm)	HSR (mm)	Total Reading TR (mm)	Corrected reading CR(mm)



Calculations:

$$\text{Depression } \delta = \frac{n\lambda}{2}$$

$$\text{Young's Modulus, } Y = \frac{3Wl^3}{2bt^3\delta}$$

Result:

The Young's modulus of the material determined by the elliptical fringes method is: $Y = \text{---} \times 10^{10} \text{ N/m}^2$.



5.BALISTIC GALVANOMETER- DETERMINATION OF HIGH RESISTANCE BY LEAKAGE METHOD

Aim:

To measure high resistance using the leakage method with a ballistic galvanometer.

Apparatus required:

Ballistic galvanometer, Capacitor, High resistance, DC power supply, Keys, Connecting wires, and Lamp and scale arrangement for deflection measurement.

Theory:

When a capacitor is charged and connected across a high resistance, it slowly discharges through the resistance. The charge leaked in a given time is proportional to the deflection of the ballistic galvanometer. The high resistance R can be calculated using the formula:

$$R = \frac{t}{C \cdot \ln \left(\frac{V_0}{V} \right)}$$

where:

- t = time of discharge
- C = capacitance
- V_0 = initial voltage
- V = final voltage after time t
- The ballistic galvanometer measures the charge leaked, which is related to the deflection observed.

Circuit diagram:

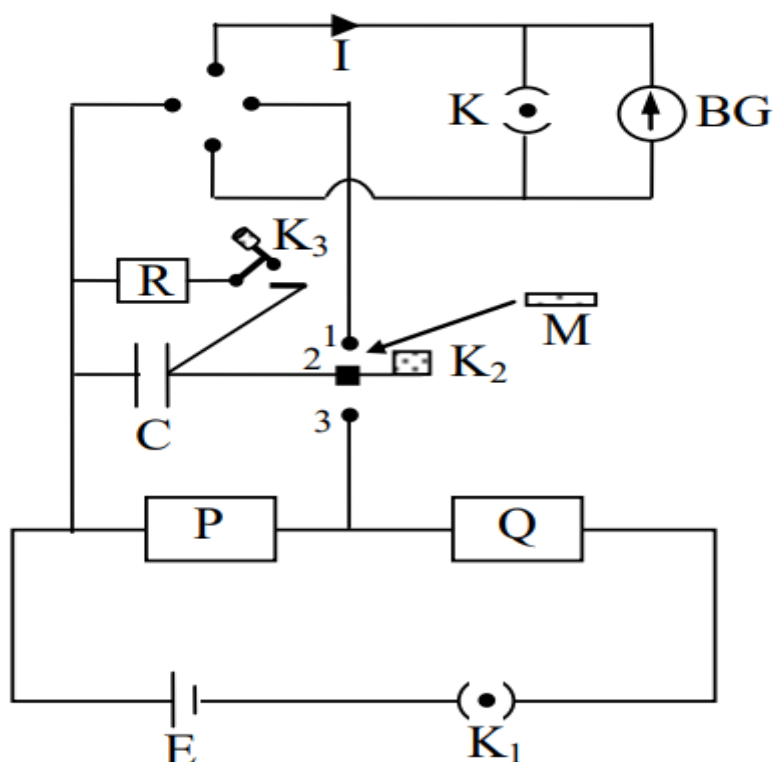


Fig.c

Figure 4.1: High resistance by BG

Procedure:

Connections are made as shown in fig.5.1. The high resistance R , whose value is to be determined, is connected across a standard capacitor C through the tap key K_3 . K_2 is a charge discharge key. In its normal position terminal 2 is in contact with terminal 1. The lamp and scale is arranged such that the distance between the mirror and scale is 1 m and the spot of light is stationary at zero line. (The spot of light can be made stationary by closing the damping key K). Introduce resistances in P and Q such that $P + Q = 10000$ ohm. P must be sufficiently large (1000 ohm) in this case. This is because we need sufficient potential difference across P so that the capacitor is charged enough to produce an appreciable throw in BG.

To begin with the experiment the tap key K_3 is made open and the charge discharge key K_2 is pressed so that the terminals 2 and 3 are in contact with each other. Key K_2 is kept pressed for about 30 seconds so that the capacitor gets charged to Q_0 . Then



after opening the damping key K the key K2 is released and thus the terminals 1 and 2 come into contact. Now the capacitor discharges completely through the BG. The throw θ_0 obtained in the BG is noted. The process is repeated by reversing the commutator and the mean value of θ_0 found.

The capacitor is again charged for the same time interval (30 seconds) to acquire the same initial charge. Introduce a small non-conducting sheet (mica sheet or a glass strip) M in between the terminals 1 and 2 of the key K2 and then it is released. Now press the tap key K3 and simultaneously starts a stop watch. K3 is kept pressed for 5 seconds and is released. Then the damping key K is made open. Now remove the non-conducting sheet M in between the terminals 1 and 2 and thus allow the capacitor to discharge the remaining charge in it through the BG. The kick in the BG is noted. The process is repeated by reversing the commutator key. Then R is calculated.

The entire experiment may be repeated for different values of 't' and 'P' and mean R is found

Observations:

Value of the capacitance C = μF = farad.

Trial No.	P ohm	Q Ohm	Throw in the galvanometer						Time of leakage 't' second	R ohm
			Without leakage			With leakage				
			θ_0 left mm	θ_0 right mm	Mean θ_0 mm	θ left mm	θ right mm	Mean θ mm		
1	1000	9000								
2	2000	8000								
3	3000	7000								
4	4000	6000								
5	5000	5000								

Mean R = Ω

Result:

The value of the given high resistance, R = ohm.



6.DESAUTY'S BRIDGE – DETERMINATION OF C, C1 AND C2 IN SERIES AND PARALLEL

Aim:

- i) To compare the capacitance of two given capacitors by forming De-Sauty bridge.
- (ii) To find the effective value of capacitance by connecting them in series and parallel by forming De-Sauty bridge.

Apparatus required:

Resistance boxes (R1 and R2), capacitors (C1, C2, C3), Ear phone, AF Oscillator (Audio frequency).

Formula:

$$1. \frac{C_1}{C_2} = \frac{R_2}{R_1}$$

$$2. \frac{C_p}{C} = \frac{R_2}{R_1}$$

$$3. \frac{C_s}{C} = \frac{R_2}{R_1}$$

C1, C2 – Two given capacitor (F)

Cp- Effective value of Capacitor In parallel(F).

Cs- Effective value of Capacitor In series(F).

C- Known Capacitance. (F)

R1, R2 – the resistance in other branches in order to get bridge balance(ohm)

Principle:

De Sauty Bridge measures an unknown capacitor in terms of standard capacitance. Two ratio are of this bridge consists of pure resistor and two capacitor where one is known value and another is standard capacitance.

Procedure:

(1) To find the capacitance of two given capacitors

- In the figure, two resistance R_1 and R_2 and two capacitors C_1 and C_2 form four arms of the De Sauty Bridge.
- The common junction of R_1 and R_2 and that of C_1 and C_2 are connected to the audio frequency oscillator.
- The circuit is completed by connecting the head phone across the bridge.
- A resistance say $100\ \Omega$ is unplugged from R_2 , a random value in R_2 is noted.
- The capacitance value for C_1 and C_2 is assumed ($C_1 = 2\ \mu\text{F}$, $C_2 = 0.5\ \mu\text{F}$).
- The resistor R_2 is adjusted until the sound waves becomes zero (i.e) no sound waves occur.
- The experiment is repeated for different values of $R_1 = 100\ \Omega$, $200\ \Omega$, $300\ \Omega$ the readings R_2 are recorded.
- The capacitors value C_1 and C_2 are calculated.

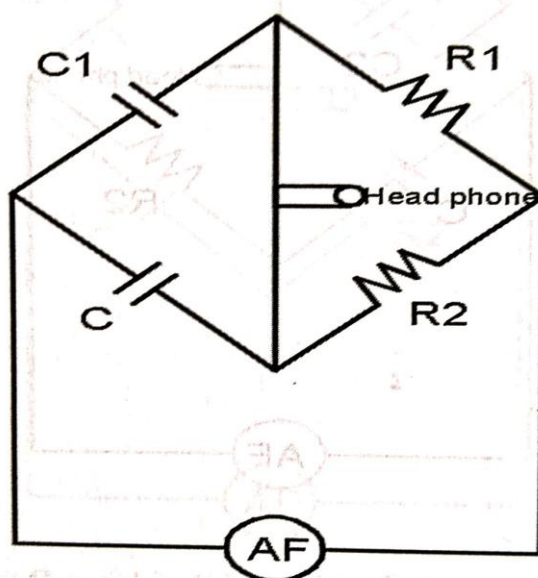


Figure 5.1 : Determination of two given capacitor

(2) To find the capacitance of capacitors in parallel

- From the figure, two resistances R_1 and R_2 are connected in two arms and the capacitors C_1 and C_2 are connected in two arms and the capacitors C_1 and C_2

connected in parallel at the opposite arm and the standard capacitor is connected.

- The common junction of resistors and the capacitors are connected to the audio frequency oscillator.
- The circuit is completed by connecting the head phone across the bridge.
- A resistance say 100Ω is unplugged from R_2 random value in R_2 is noted.
- The capacitance value for C_1 and C_2 is applied which was calculated from the observed table.
- The resistors R_2 is adjusted until the sound waves becomes zero (i.e) no sound waves occur.
- The experiment is repeated for different values of $R_1 = 100\Omega, 200\Omega, 300\Omega$ and the readings R_2 are recorded.
- The capacitance value C_1 and C_2 is calculated by $\frac{C_s}{C} = \frac{R_2}{R_1}$.

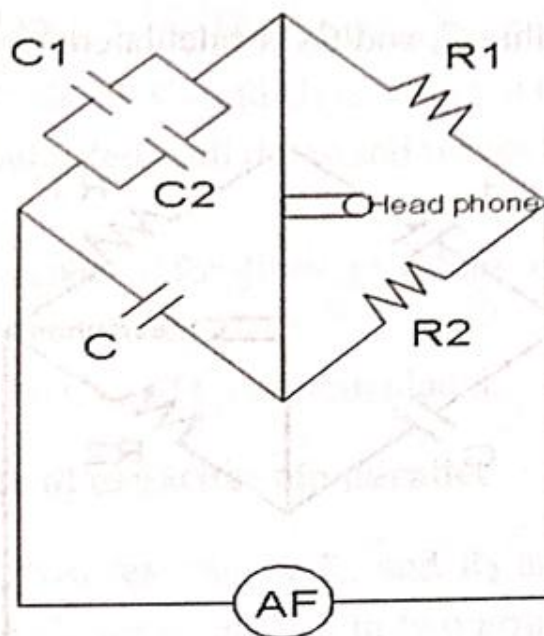


Figure6.2: capacitance of capacitors in parallel.

3) To find the capacitance of capacitors in series

- From the figure, two resistances R_1 and R_2 are connected in two arms and the capacitor C_1 and C_2 are connected in series at the opposite arm and the standard capacitances is connected.

- The common junction of resistors and the capacitors are connected to the audio frequency oscillator.
- The circuit is completed by connecting the head phone across the bridge.
- A resistance say 100Ω is unplugged from R_2 , a random value in R_2 is noted.
- The capacitance value for C_1 and C_2 is applied which was calculated from the observed table.
- The resistors R_2 is adjusted until the sound waves becomes zero (i.e) no sound waves occur.
- The experiment is repeated for different values of $R_1 = 100\Omega, 200\Omega, 300\Omega$ and the readings R_2 are recorded.
- The capacitance value C_1 and C_2 is calculated by $\frac{C_1}{C_2} = \frac{R_2}{R_1}$.

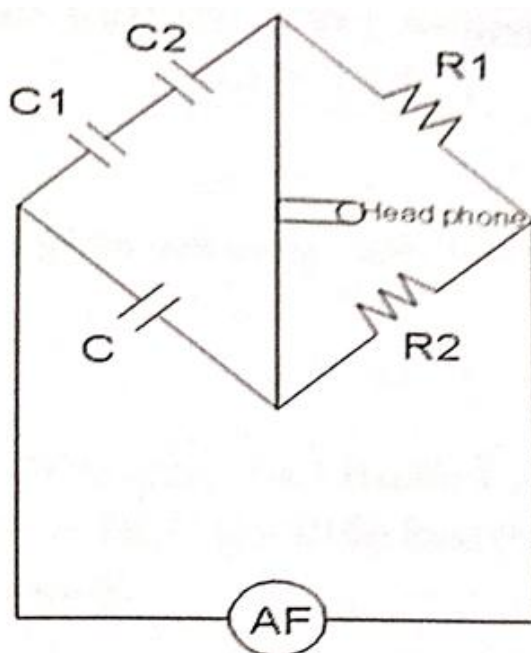


Figure 6.3: capacitance of capacitors in series.

Observations:

Table 1: To find the capacitance of the two given capacitors

$C_1 = \dots\dots\dots \mu F$;

$C_2 = \dots\dots\dots \mu F$

S.NO	$R_1(\Omega)$	$R_2(\Omega)$	$\frac{C_1}{C_2} = \frac{R_2}{R_1} \mu F$



$$\text{Mean } \frac{C_1}{C_2} = \mu F$$

Table 2: To determine the capacitance of capacitors in parallel

$$C_1 = \text{_____ } \mu F; \quad C_2 = \text{_____ } \mu F; \quad C = \text{_____ } \mu F$$

$$C_p = C_1 + C_2; \quad C_p = \text{_____ } \mu F$$

S.NO	R1(Ω)	R2(Ω)	$\frac{C_p}{C} = \frac{R_2}{R_1} \mu F$

$$\text{Mean } \frac{C_p}{C} = \mu F$$

Table 3: To determine the capacitance of capacitors in series.

$$C_1 = \text{_____ } \mu F; \quad C_2 = \text{_____ } \mu F; \quad C = \text{_____ } \mu F$$

$$\frac{1}{C_s} = \frac{1}{C_1} + \frac{1}{C_2}$$

$$C_s = \text{_____ } \mu F$$

S.NO	R1(Ω)	R2(Ω)	$\frac{C_s}{C} = \frac{R_2}{R_1} \mu F$

$$\text{Mean } \frac{C_s}{C} = \mu F$$



Result:

- The capacitance of the two given capacitors is compared by forming De-Sauty bridge $\frac{C_1}{C_2} =$ μF
- The capacitance of the capacitor in parallel is found by forming De-Sauty bridge $C_p =$ μF .
- The capacitance of the capacitor in parallel is found by forming De-Sauty bridge $C_s =$ μF .



7.BI PRISM – DETERMINATION OF WAVELENGTH

Aim:

To determine the wavelength (λ) of monochromatic light by observing interference fringes produced by a Fresnel's Bi-Prism.

Apparatus required:

Fresnel's Bi-Prism, Sodium vapor lamp ($\lambda \approx 5893 \text{ \AA}$), Narrow single slit and adjustable double slit system (or single slit + lens arrangement), Lens of known focal length, Travelling microscope, Optical bench with four adjustable stands, Scale for measuring distances, Screen.

Theory:

Fresnel's Bi-Prism produces two virtual coherent sources from a single slit by refraction at its two inclined faces. The overlapping light from these virtual sources produces an interference pattern of bright and dark fringes on the screen or microscope field.

Formula:

The wavelength of light is given by

$$\lambda = \frac{\beta \cdot 2d}{D}$$

D = distance between slit and the eyepiece,

$2d$ = distance between the two virtual sources,

β = fringe width.

$$2d = \sqrt{d_1 \cdot d_2}$$

Where,

d_1 = distance between the two image formed by the convex lens in the first position.

d_2 = distance between the two image formed by the convex lens in the second position

Diagram:

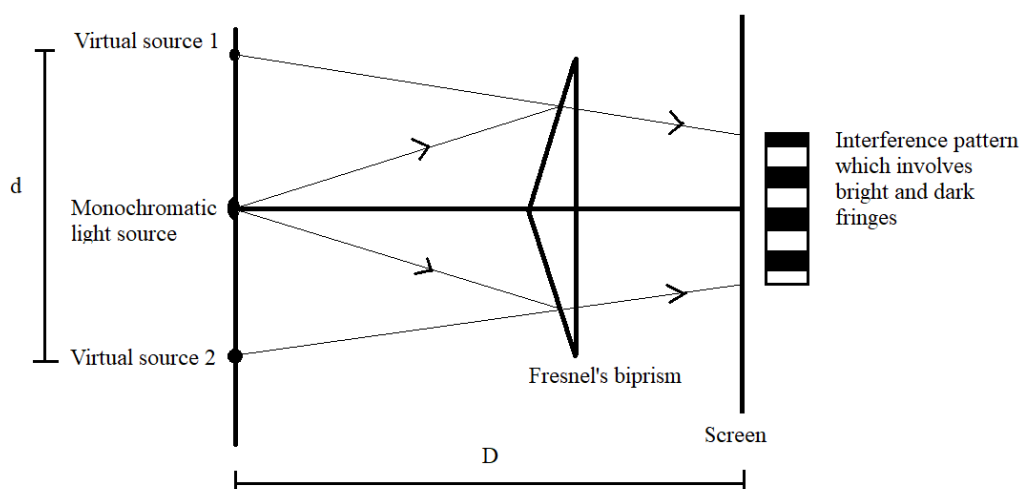


Figure 6.1 : Frenels biprism

Procedure:

(1) Adjustment

- The height of the slit biprism and eyepiece is adjusted at the same level.
- The biprism upright is placed near the slit. The slit is made narrow and vertical. It is illuminated with sodium light. Looking through the biprism two images of the source will be seen. The eye is moved side ways when one of the images will appear to cross the edge of the biprism from one side to the other. If the refracting edge of the biprism is parallel to the slit, the images as a whole will appear to cross the edge. Otherwise when adjustment is faulty, either the top or the bottom of the image will cross the edge first. The biprism is adjusted by rotating it in its own plane to effect the sudden transition of the full image.
- The eyepiece is placed near biprism and the biprism upright is moved perpendicular to the biprism till fringes or a patch of light is visible. If the fringes are not seen the biprism is rotated in its cross plane.
- If fringes are not clear reduce the slit width slightly.
- The vertical cross wire is adjusted on one of the bright fringe at the center of the fringe system and the eyepiece is moved away from the biprism. In doing, if fringes give a lateral shift, it must be removed in the following way. From any position, the eyepiece is moved away from the biprism and at the same time a lateral shift is given to the biprism with its base screw so that the vertical cross-wire remains on the same fringe on which it was adjusted. The eyepiece is now moved towards the biprism and this procedure is repeated few times till the lateral shift is removed.

2. Measurement of β : (Fringe width)

- The eyepiece is fixed about 100cm away from the slit.
- The vertical crosswire is set on one of the bright fringes and the reading on the eyepiece scale is noted.
- The crosswire is moved on the next bright fringe and the reading is noted. In this way observation are taken for about 20 fringes.

3. Measurement of D: (distance between source and screen)

- The distance between the slit and eyepiece gives D.

4. Measurement of $2d$: (distance between the two sources on screen)

- For this part the distance between the eyepiece and slit should be kept slightly more than four times the focal length of lens. If necessary the position of the slit and the biprism should not be altered.
- The convex lens is introduced the biprism and eyepiece and is placed near to the eyepiece. The lens is moved towards the biprism till two sharp images of the slit are seen. The distance d_1 is measured by the micrometer eyepiece.
- The lens is moved towards the biprism till two images are again seen the distance between these two images give d_2 .
- At least two sets of observation for d_1 and d_2 are taken.

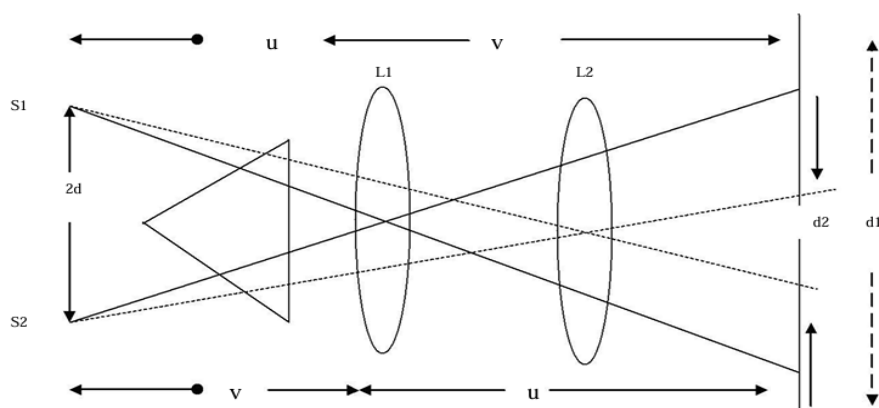


Figure 7.2 Determination of distance between two sources.



Observation

Table 1: β (fringe width)

No of division on the vernier scale =

Least count of Vernier =

No of fringe	Micrometer reading(a)			No of fringe	Micrometer reading(b)			Difference for 10 fringe	Mean for 10 fringe	Fringe width (mm) $\beta = \frac{\text{Mean}}{10}$
	MS	VS	Total (mm)		MS	VS	Total (mm)			
1				11						
2				12						
3				13						
4				14						
5				15						
6				16						
7				17						
8				18						
9				19						
10				20						

Measurement of D:

Position of the slit (a) = -----cm

Position of the eyepiece (b) = -----cm

Observation value of D (b-a) = -----cm

Table 2: Measurement of 2d

Micrometer Reading												$2d = \sqrt{d_1 d_2}$	Mean 2d
Observation for d_1						Observation for d_2							
Position of I Image			Position of II Image			Position of I Image			Position of II Image				
MS	VS	Total	MS	VS	Total	MS	VS	Total	MS	VS	Total		
									</				



Calculations:

$$\lambda = \frac{\beta \ 2d}{D}$$

Result:

The wavelength of sodium light was found to be approximately 610 nm using the Fresnel biprism method. This value is close to the accepted standard wavelength of 589 nm, confirming the accuracy of the experiment.



8.SPECTROMETER I – I' CURVE

Aim:

To determine the angle of emergence i' for various angle of incidence i and to draw the i - i' curve.

Apparatus required:

Spectrometer, equilateral prism, sodium light etc.

Formula:

$$\mu = \frac{\sin \frac{A+D}{2}}{\sin \frac{A}{2}} \text{ No unit}$$

Where, μ -the refractive index of the prism (No unit).

A-is the angle of the prism (degree)

D- The angle of deviation (degree)

Diagram :

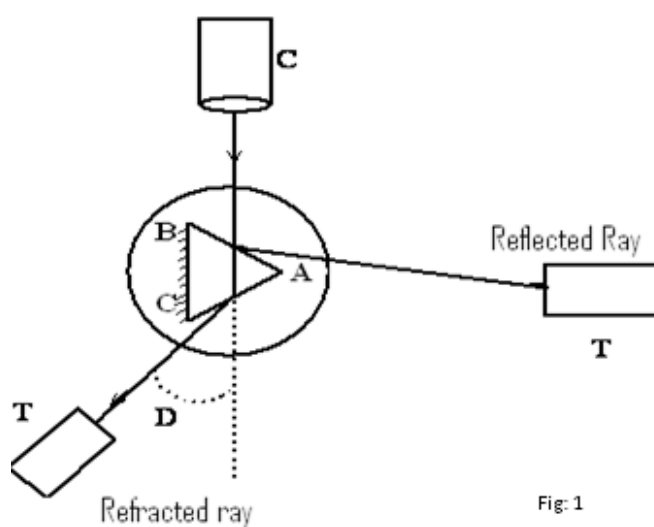


Figure 7.1 Spectrometer i - i' setup

Model graph:

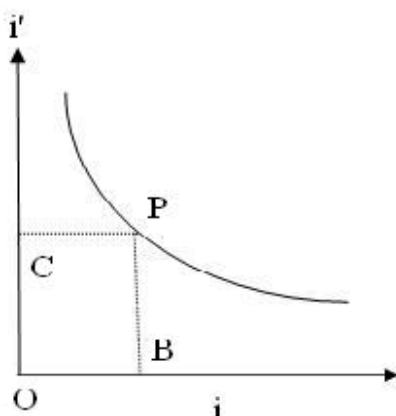


Figure 8.2: model graph $i - i'$ curve

Procedure:

The telescope is brought in line with the collimator and the image of the lit is viewed through it. The telescope is adjusted to make the vertical cross wire coincides with the image of the slit. The readings of anyone of the verniers are taken. To set the prism for angle of incidence i of the telescope is rotated through an angle $\theta = (180 - 2i)$ from the direct reading position and clamped. The prism is mounted on the prism table with its grounded face towards the clamp and is rotated so that its reflecting edge is turned away from the collimator.

Looking through the telescope, the vernier table is rotated as that reflected image of the slit coincides with the vertical crosswire. Now the angle of incidence is equal to i . The vernier table is then fixed.

The telescope is released and is rotated so that the refracted image of the slit is obtained at the vertical cross-wire. The telescope is then fixed in this position. Looking through the telescope with vernier table is rotated in such a direction that the refracted image moves towards the minimum deviation position and then returns to the vertical crosswire. Now, the deviation is the same as before: but the angle of incidence is i' . The vernier is clamped. The telescope is released and rotated to obtain the reflected image of the slit at the crosswire. The telescope is fixed and the reading of both the verniers is taken. The telescope is released and is brought to obtain the direct image at its cross wire. The readings of both verniers are taken. The difference between the reflected reading and direct reading θ_2 is found. Now $\theta_2 = (180 - 2i')$. Thus

$$i' = \frac{180^\circ - \theta_2}{2}$$



The experiment is repeated for various values of i and i' is calculated in each case.

A graph is drawn with angle of incidence i along X-axis and the angle of emergence i' along Y-axis. The graph is a rectangular parabola. From it, angle of incidence corresponding to minimum deviation is calculated.

Observation:

Table 1: To find i

Direct ray reading $VA=0$, $VB=180$

S. No	Angle of incident (i)	180-2i	Reflected reading		$\theta = 180-2i$		$i' = 90 - \frac{\theta}{2}$		Mean i'
			VA	VB	VA	VB	VA	VB	
1	35 °	110							
2	40 °	100							
3	45 °	90							
4	50 °	80							
5	55 °	70							

Table 2: To find the angle of prism A

Position	Reflected reading						Difference (2A)	Angle of prism (A)
	Vernier A			Vernier B				
	MSR	VSR	CR	MSR	VSR	CR		
Face –I								
Face-II								



Calculation:

The refractive index of the material is

$$\mu = \frac{\sin \frac{A + D}{2}}{\sin \frac{A}{2}}$$

Result:

The refractive index of the material of the prism is determined by i-i' curve method.

The refractive index of the material of the prism is (μ) = ----- no unit.

