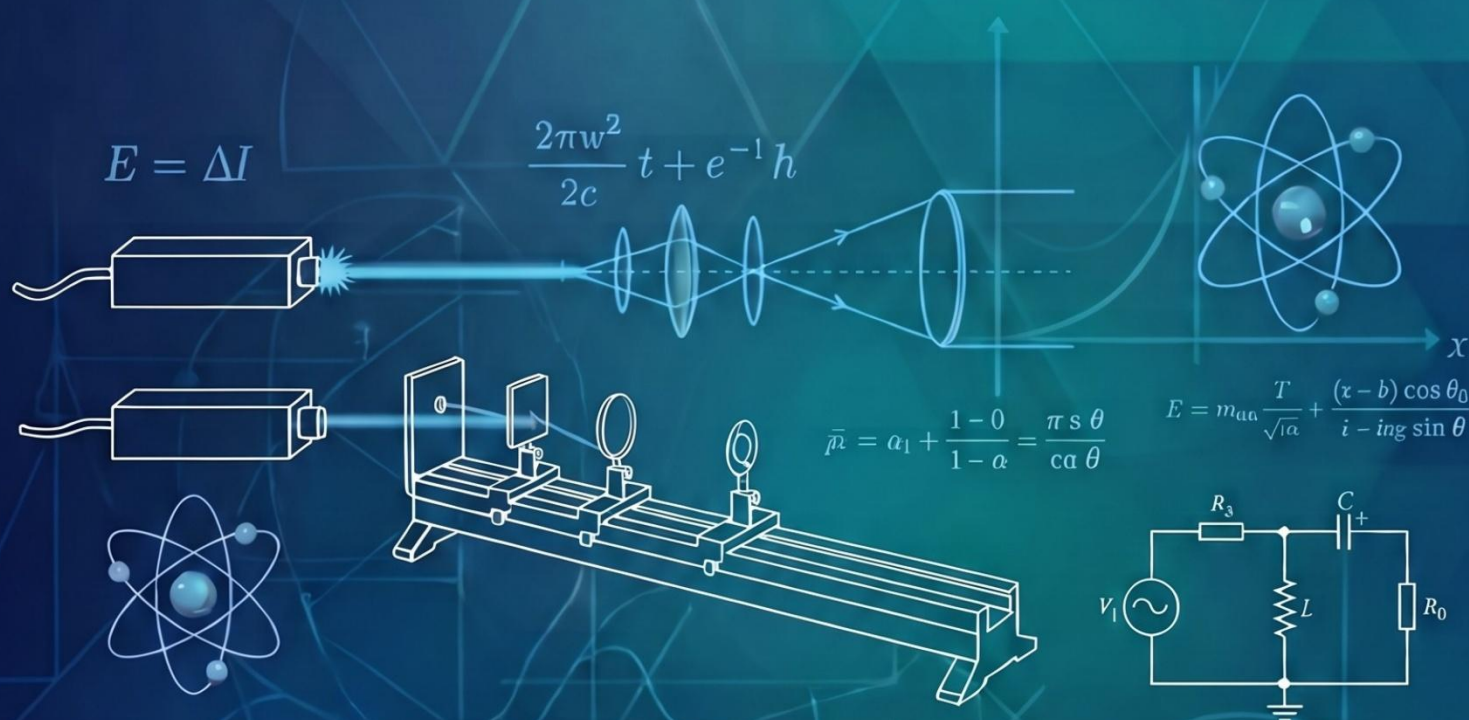


PRACTICAL HANDBOOK FOR B.Sc. PART III PHYSICS

AS PER NEP-2020 (2.0) SYLLABUS OF
SHIVAJI UNIVERSITY, KOLHAPUR
(IMPLEMENTED FROM JUNE 2026)



Authors:

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Mr. G. S. Patil
Mr. K. M. Gurav



Bhumi Publishing, India
First Edition: 2026

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PREFACE

It gives us immense pleasure to present this Practical Handbook for B.Sc. Part III Physics, prepared in accordance with the curriculum of Shivaji University, Kolhapur, following the revised syllabus effective from June 2026. This handbook is designed as a guide to help learners to perform practical experiments accurately, confidently, and scientifically.

Practical work is an essential component of physics education. It transforms theory into practical understanding through observation, experimentation, measurement, and analysis. The experiments are selected to develop experimental skills, quantitative reasoning, accurate measurement, data interpretation, and application of physical laws. The experiments in mechanics, properties of matter, and acoustics provide practical understanding of resonance, vibrations, surface tension, elasticity, sound waves, stationary waves, wavelength, frequency, and velocity of sound. Optics experiments strengthen geometrical and physical optics through cardinal points, diffraction, dispersion, polarization, Malus' law, and spherical aberration. These activities develop precise understanding of light. The electrical and magnetic experiments develop scientific measurement skills and introduce self-inductance, AC bridge methods, low and high resistance, capacitance, galvanometer techniques, and dielectric properties. Electronics experiments extend practical knowledge of digital and analog systems through logic gates, universal gates, negative feedback, operational amplifiers, Schmitt triggers, and IC-555-based multivibrators. They enable students to understand circuits, analyze results, and apply electronic principles. Collectively, these experiments bridge the gap between theoretical concepts and practical applications. They cultivate scientific curiosity, experimental accuracy, analytical reasoning, critical thinking, problem-solving ability, observation, data interpretation, and laboratory skills. The handbook is intended for practical examinations and for developing scientific temperament, independent thinking, and appreciation of experimental physics.

This Practical Handbook has been prepared as part of the Memorandum of Understanding (MOU) between Shivraj College of Arts, Commerce & D. S. Kadam Science College, Gadhinglaj, and Yashwantrao Chavan Mahavidyalaya, Halkarni, Chandgad.

We express our gratitude to the managements of Shivraj Vidya Sankul, Gadhinglaj President, Hon. Prof. Kisanrao Kurade, Secretary Hon. Dr. Anilrao Kurade, Vice President Hon. Adv. Digvijay Kurade, Director Mr. Vishwajeet Kurade & Daulat Vishwasth Sanstha's, Senior Director, Hon. Gopalrao Patil, Chairman, Hon. Ashokrao Jadhav, Vice-Chairman, Hon. Sanjay Patil, Secretary Vishal Gopalrao Patil, As well as Shivraj College of Arts, Commerce & D. S. Kadam Science College, Gadhinglaj Principal Prof. Dr. S. M. Kadam & Yashwantrao Chavan Mahavidyalay, Halkarni Principal Prof. Dr. I. R. Jarali for their cooperation and encouragement.

We hope this handbook will be a companion helping students to develop skills for successful examinations and lifelong scientific learning and continued growth.

We wish all students a practical-learning experience.

- Authors

ACKNOWLEDGEMENT

The journey of bringing Creative Convergence in the Digital Era to completion has been an enriching experience of learning, collaboration, and shared academic endeavour. As editors, we gratefully acknowledge everyone whose support, guidance, encouragement, and goodwill contributed to the successful completion of this Practical Handbook.

We express our deepest gratitude to our parents for their unconditional love, prayers, sacrifices, and unwavering faith in us. Their constant support has been a quiet, yet powerful source of strength behind every academic achievement and has inspired us to pursue our goals with dedication and perseverance.

We extend our sincere appreciation to our respected teachers, the faculty members and supporting staff of the Department of Physics, and all our academic well-wishers for generously sharing their knowledge, experience, and valuable guidance. Their encouragement has enabled us to approach this project with greater confidence, commitment, and academic purpose.

As editors, we would also like to acknowledge and appreciate one another. The successful completion of a collaborative academic work requires patience, understanding, responsibility, mutual respect, and trust. The thoughtful discussions, shared responsibilities, constructive suggestions, and collective decisions among us have played an important role in bringing this project to fruition. We are sincerely thankful for the cooperation, dedication, and commitment demonstrated by each editor throughout this journey.

We express our heartfelt gratitude to the management and leadership of Shivraj Vidya Sankul, Gadhinglaj—President Hon. Prof. Kisanrao Kurade, Secretary Hon. Dr. Anilrao Kurade, Vice-President Hon. Adv. Digvijay Kurade, and Director Mr. Vishwajeet Kurade—for their valuable encouragement, support, and guidance. We also extend our sincere appreciation to Daulat Vishwasth Sanstha and its esteemed office bearers—Senior Director Hon. Gopalrao Patil, Chairman Hon. Ashokrao Jadhav, Vice-Chairman Hon. Sanjay Patil, and Secretary Mr. Vishal Gopalrao Patil—for their encouragement and continued support in our academic endeavours.

Our sincere thanks are also due to the staff of Shivraj College of Arts, Commerce & D. S. Kadam Science College, Gadhinglaj, particularly Principal Prof. Dr. S. M. Kadam, and Yashavantrao Chavan Mahavidyalaya, Halkarni, particularly Principal Prof. Dr. I. R. Jarali, for their valuable encouragement, cooperation, and academic support. We are grateful to everyone who offered assistance, guidance, or encouragement during the preparation of this volume. Every gesture of support, however small, contributed meaningfully to keeping this endeavour moving forward.

Finally, we express our heartfelt gratitude to everyone who became a part of this academic journey in one way or another. This book is not merely a collection of scholarly contributions; it is also a reflection of the spirit of collaboration, intellectual curiosity, creativity, and a shared commitment to the pursuit and dissemination of knowledge.

With sincere gratitude and deep appreciation, we dedicate this work to all those who have supported, inspired, and encouraged us throughout this journey. Their continued faith and goodwill will remain a source of inspiration as we move forward towards new academic horizons and future scholarly endeavours.

- Authors

SYLLABUS

Physics LAB Semester-V Major: Practical V (b)

Group I

1. Resonance pendulum
2. Surface tension of soap solution
3. Surface tension of mercury by Fergusson's modified method
4. Surface tension of a liquid by method of ripples.
5. γ by flat spiral spring
6. Velocity of sound using Kundt's tube /CRO
7. Frequency of electrically maintained tuning fork by Melde's experiment

Group II

1. Cardinal points by turn table
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3. Diffraction at single slit
4. Determination of Cauchy's constants
5. Diffraction at cylindrical obstacle
6. Verification of Malus' Law using Polarized Light.
7. Spherical aberration

Physics LAB Semester-V Major: Practical V (b)

Group I

1. Self-inductance by Owen's bridge
2. Self-inductance by Maxwell's bridge
3. Measurement of low resistance by Carey-Foster's bridge
4. Resistance of BG by half deflection method
5. Absolute capacity of condenser using BG
6. High resistance by leakage method using BG
7. Measurement of dielectric constant of given material

Group II

1. To verify the truth tables of NAND, NOR, Ex-OR and Ex-NOR gates by using basic gates with IC-74series.
2. NAND and NOR gates as universal gate
3. Negative feedback amplifier
4. To study Op-amp as an inverting amplifier
5. Op-Amp as Schmitt trigger
6. To design and test an astable multivibrator using IC-555 Timer
7. To design and test monostable multivibrator using IC-555 Timer.

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Group I			
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Experiment No. 1 RESONANCE PENDULUM

Aim:

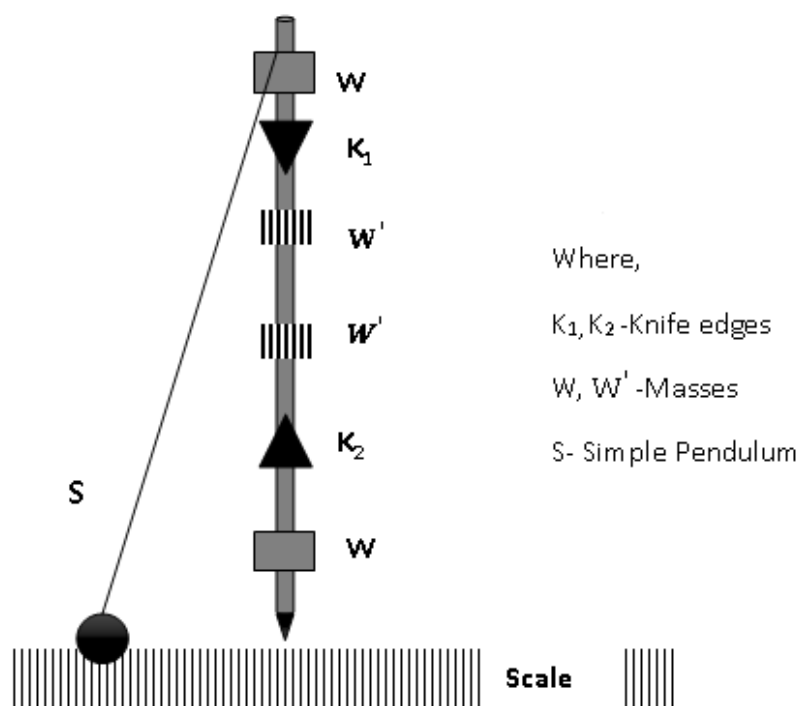
To determine,

1. The resonating length of a simple pendulum attached to the Kater's pendulum.
2. The damping coefficient of air.

Apparatus:

Kater's pendulum, simple pendulum, stopwatch, metre scale, fractional weight box, telescope, and other necessary accessories.

Diagram:



Formulae:

1. $n^2 = \frac{g}{l_0}$
2. $P = \frac{2\pi}{T}$
3. $\gamma^2 = \frac{(n^2 - p^2) \times \text{Slope}}{\text{Intercept on } \frac{1}{A^2} \text{ Axis} \times p^2}$

Observations:

1. Time required for 10 oscillations of Kater's pendulum, $t = \underline{\hspace{2cm}}$ sec.
2. Period of Kater's pendulum, $T = \frac{t}{10} = \underline{\hspace{2cm}}$ sec.
3. Constant amplitude supplied to Kater's pendulum = 2 cm.
4. Mass of the pan (m_1) = $\underline{\hspace{2cm}}$ g.

Observation Table I:

To find resonating length (l_0):

Mean Position reading = X_0 = _____ cm.

Obs. No.	Length of simple pendulum ' l ' cm	Maximum displacement ' X ' cm	Amplitude $A = (X - X_0)$ cm
1.			
2.			
3.			
4.			
5.			

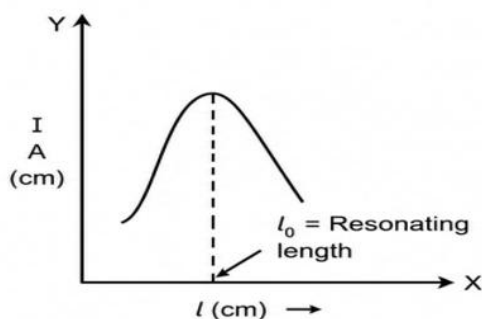
Obs. No.	Mass in the pan ' m ' gm	Total Mass $M = m + m_1$ gm	Maximum displacement ' X ' cm	Amplitude $A = (X - X_0)$ cm	$\frac{1}{A^2}$	$\frac{1}{M^2}$
1.						
2.						
3.						
4.						
5.						

Observation Table II:

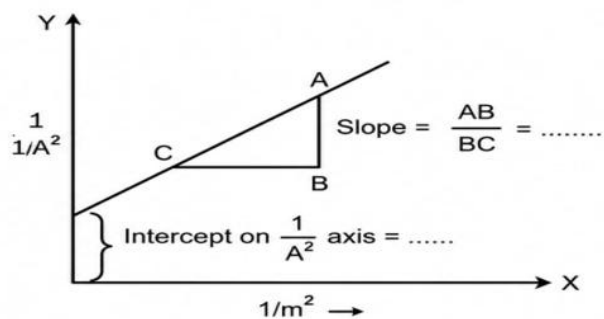
Nature of Graphs:

Plot a graph of A Vs l from observation Table-I as shown in fig.(a).

Plot a graph of $\frac{1}{A^2}$ Vs $\frac{1}{M^2}$ from observation Table-I as shown in fig.(b).



(a) For resonating length



(b) Graph between $1/A^2$ and $1/m^2$

Procedure:

▪ **Exp.al setup:**

1. Arrange the Exp.al setup as shown in Fig. (I).
2. Suspend the Kater's pendulum from one of its knife edges. Attach a simple pendulum of length l cm to a fixed point on the Kater's pendulum. The bob of the simple pendulum consists of a pan in which different masses can be placed.

▪ **Determination of resonating length:**

1. Initially, set the length of the simple pendulum to $l = 70$ cm and keep the pan empty.
2. Displace the Kater's pendulum through approximately 2 cm from its equilibrium position and release it.
3. Due to resonance, the simple pendulum begins to oscillate with increasing amplitude. Measure and record the maximum amplitude A attained by the simple pendulum.
4. Repeat the Exp. for simple-pendulum lengths of 75 cm, 80 cm, 85 cm, and 90 cm.
5. Record all observations in Observation Table I.
6. Plot a graph of amplitude A versus length l .
7. The value of l corresponding to the maximum amplitude is taken as the resonating length l_0 .
8. Set the length of the simple pendulum equal to the resonating length l_0 .
9. Maintain a constant displacement of approximately 2 cm for the Kater's pendulum.
10. Initially, keep the pan empty. Let the mass of the pan be m_1 , and determine the maximum amplitude A of the simple pendulum.
11. Add different known masses to the pan successively and repeat the Exp. for each value of the total mass M .
12. Record the corresponding values of A in Observation Table II.
13. Calculate $1/A^2$ and $1/m^2$ for each observation.
14. Plot a graph between $1/A^2$ and $1/m^2$.

Calculations:

$$\gamma^2 = \frac{(n^2 - p^2) \times \text{Slope}}{\text{Intercept on } \frac{1}{A^2} \text{ Axis} \times p^2}$$

Results:

1. Resonating length (l_0) = _____ cm
2. The damping coefficient of air by resonance pendulum (γ) = _____ cm/sec

Oral questions

1. What is a resonance pendulum?
2. What is a simple pendulum?
3. What is the value of acceleration due to gravity?
4. What is the difference between free and forced vibrations?

Experiment No. 2

SURFACE TENSION OF SOAP SOLUTION

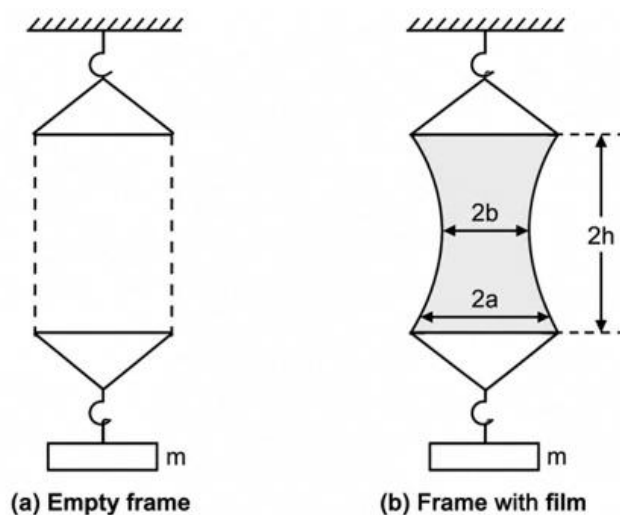
Aim:

To determine the surface tension of given soap solution.

Apparatus:

Frame, fractional weights, soap solution, meter scale, etc.

Diagram:



Formula:

$$T = \frac{mg}{2(a + b + \frac{h^2}{a - b})}$$

Where, $2a$ = width of the film at the frame

$2b$ = width of the film at the center

$2h$ = vertical height of the film

Observations:

1. Mass of the lower frame(m_1) = _____ gm
2. Acceleration due to gravity(g) = 980 cm/sec^2

Observation Table:

Obs. No.	Mass attached 'm' mg	Distances in cm						Surface tension 'T' dyne/cm	Mean T dyne/cm
		2a	a	2b	b	2h	h		
1									
2									
3									
4									

Calculations:

$$T = \left(\frac{mg}{2 \left(a + b + \frac{h^2}{a-b} \right)} \right)$$

Procedure:

1. Construct the frame as shown in Figure
2. Prepare the soap solution. Dip the frame into the soap solution and place it vertically, as shown in Fig. For a mass m attached to the frame, measure the parameters $2h$, $2a$, and $2b$. Repeat this for different values of the attached mass m .
3. Enter the readings in the observation table.
4. Complete the observation table and calculate the mean value of the surface tension (T) of the soap solution.

Result:

Surface tension of the soap solution, $T = \underline{\hspace{2cm}}$ dyne/cm.

Oral questions

1. What is surface tension?
2. What is the principle of the Exp.?
3. What is cohesion?
4. What is adhesion?

Experiment No. 3

SURFACE TENSION OF MERCURY BY FERGUSSON'S MODIFIED METHOD

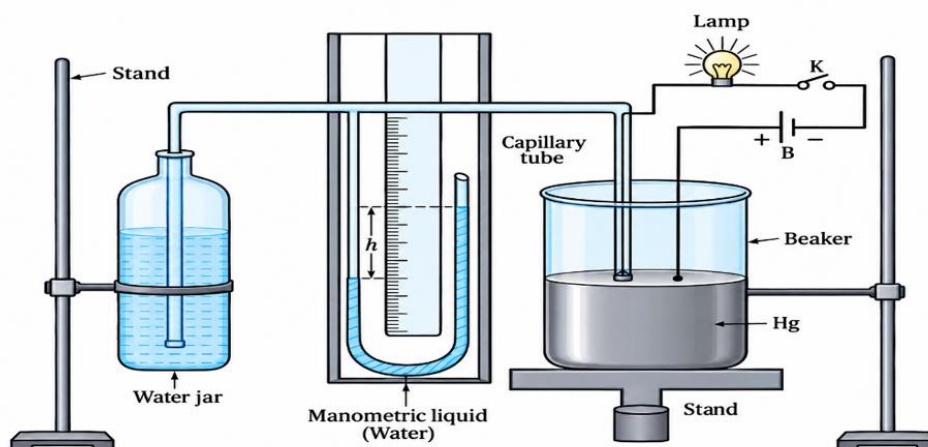
Aim:

To determine the surface tension of mercury by Fergusson's modified method.

Apparatus:

Mercury, manometer, water jar, beaker, bulb, battery cell, capillary tube, travelling microscope, connecting wires, etc.

Diagram:



Formula:

$$T = \frac{r h \rho g}{2 \cos \theta}$$

Where,

r – radius of capillary tube.

h – height of liquid column in the manometer

ρ – density of manometer liquid = 1 gm/cm³

θ – angle of contact = 140° ,for mercury and glass

T - surface tension of mercury

g - acceleration due to gravity=980cm/ sec²

Observation Table I:

Scale used	Micrometer reading at		Diameter of capillary tube D= (X-Y) cm	Radius of capillary tube(r) cm	Mean radius r cm
	Side I X cm	Side II Y cm			
Vertical					
horizontal					

Observation Table II:

For manometric height

Obs. No.	Micrometer reading at		Manometric height h= h ₁ - h ₂ cm
	First arm h ₁ cm	Second arm h ₂ cm	
1			
2			
3			
4			

Calculations:

$$T = \frac{r h \rho g}{2 \cos \theta}$$

Procedure:

1. Set up the Experimental arrangement as shown in Fig.I. Ensure that one end of the circuit wire is in contact with the mercury in the beaker, while the other end passes through the capillary tube and is positioned at the same level as the mercury surface in the beaker.
2. Close the circuit by placing the key K. Slowly move the tube dipped in the beaker, which is connected to the manometric arm, in the upward direction until the lamp just starts glowing. At this point, note the liquid heights h_1 and h_2 in the two arms of the manometer.
3. Record these readings in Observation Table-II. Repeat the Exp. two more times.
4. Measure the diameter of the capillary tube using the vertical and horizontal scales of the travelling microscope. Record the readings in Observation Table-I.
5. Using the given formula, calculate the surface tension (T) for each observation. Find the mean value of T.

Result:

The surface tension of the given mercury (Hg), determined by Fergusson's modified method, is, $T = \text{_____}$ dyne/cm.

Oral questions

1. What is the principle of Fergusson's method?
2. Why is mercury used in this Exp.?
3. What is capillarity?
4. What is the contact angle for mercury with clean glass?

Experiment No. 4

SURFACE TENSION OF LIQUID USING RIPPLE METHOD

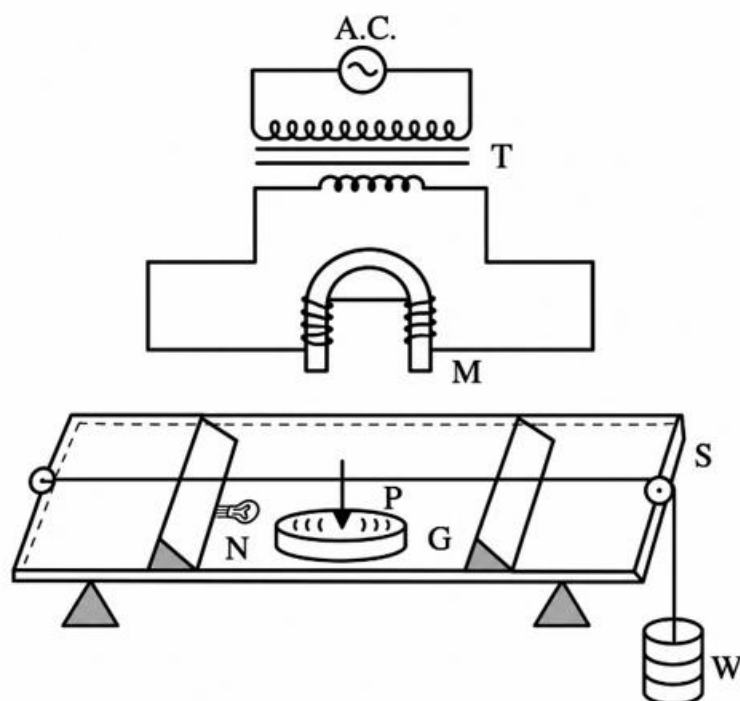
Aim:

To determine the surface tension of given liquid(water) using ripple method.

Apparatus:

Electromagnet, sonometer with magnetic wire, water, lamp, pin, weights, glass plate bowl, etc.

Diagram:



Experimental arrangement of ripple method

Where,

M- Electromagnet

S- Sonometer

T- Step down transformer

N- Lamp

G- Glass plate bowl

W- Weights

Formula:

$$T = \frac{\lambda^2 \rho}{4\pi^2} (2\pi n^2 \lambda - g)$$

Where,

T- Surface tension of given liquid

λ – Wavelength of ripples on the liquid surface

ρ – Density of given liquid

n – Frequency of electromagnet

g – Acceleration due to gravity = 980 cm/sec²

Observations:

1. Frequency of electromagnet = n = _____ Hz
2. Density of given liquid(water) = 1gm/cm³

Observation Table:

Obs. No.	Number of ripples N	Distance d cm	$\lambda = \frac{d}{N}$ cm	Mean λ cm
1				
2				
3				
4				
5				

Calculations:

$$T = \frac{\lambda^2 \rho}{4\pi^2} (2\pi n^2 \lambda - g)$$

Procedure:

1. Pour the given liquid into glass-plate bowl it. Place the bowl below the sonometer such that the pin attached to the sonometer wire just touches the surface of the liquid.
2. Apply suitable weights to the free end of the sonometer wire. Position the electromagnet close to the wire and switch it ON. Adjust its position until the sonometer wire starts vibrating.
3. The vibrating wire causes ripples to form on the surface of the liquid in the glass-plate bowl. These ripples can be observed clearly when the liquid surface is illuminated by a neon lamp.
4. Count the number of ripples (**N**) produced and measure the distance (**d**) between the successive ripples.
5. Record the observations in the observation table.
6. Using the formula, calculate the surface tension (T) of the given liquid.

Result:

Surface tension of the given liquid, $T = \underline{\hspace{2cm}}$ dyne/cm.

Oral questions

1. What is surface tension?
2. What is the principle of the ripple method?
3. What are ripples?
4. What is the main observation in this Exp.?

Experiment No. 5

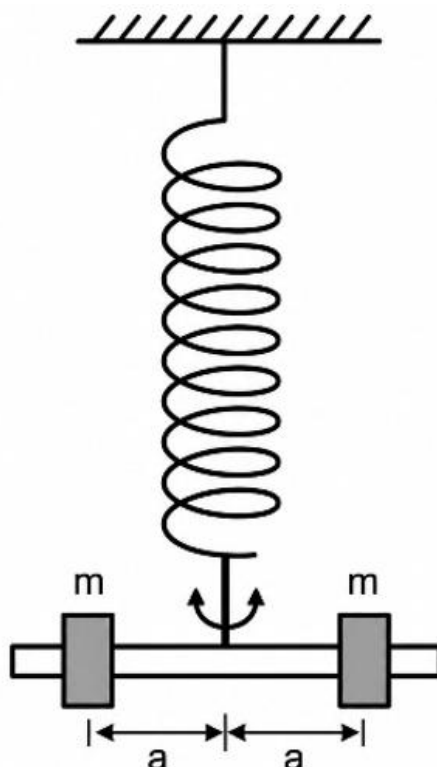
Y BY FLAT SPIRAL SPRING

Aim:

To determine the Young's modulus (Y) of a material of flat spiral spring.

Apparatus:

Flat spiral spring, stand, stop watch, vernier caliper, micrometer screw gauge, rod with two discs, etc.

Diagram:**Formula:**

$$Y = \frac{32 \pi^2 N R}{r^4} \times \text{Slope}$$

Where,

Y = Young's Modulus

N = No. of turns of the spring

R = Radius of the spring

r = Radius of the wire

Observations:

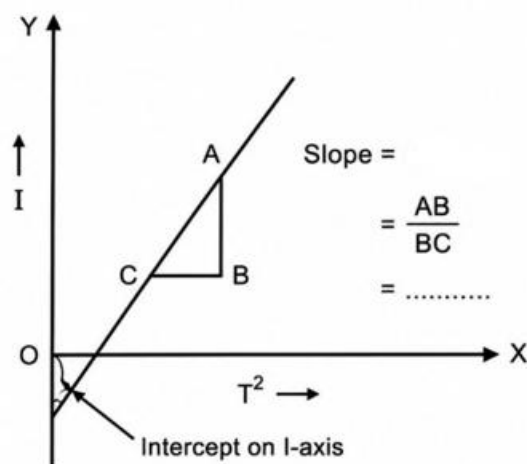
1. L.C. of vernier caliper = _____ cm
2. L.C. of micrometer screw gauge = _____ cm
3. Outer diameter of spiral spring(d1) = _____ cm
4. Inner diameter of spiral spring(d2) = _____ cm

5. Mean diameter (D) = $\frac{d_1+d_2}{2}$ = _____ cm
6. Radius of spiral spring (R) = $\frac{D}{2}$ = _____ cm
7. Number of turns of spiral spring (N) = _____
8. Mass of two discs (2m) = _____ gm
9. Mass of spiral spring (M) = _____ gm
10. Diameter of wire of spiral spring = d = _____ cm
11. Radius of wire of spiral spring = r = $\frac{d}{2}$ = _____ cm

Observation Table:

Obs. No.	Distance of each disc from Centre 'a' cm	Time for 20 oscillations (sec)			Mean time 't' sec	Period $T = \frac{t}{20}$ sec	I = 2ma ² gm .cm ²	T ² Sec ²
		I	II	III				
1.								
2.								
3.								
4.								

Nature of Graphs:



Graph between I and T²

Calculations:

$$Y = \frac{32 \pi^2 NR}{r^4} \times \text{Slope}$$

Procedure:

1. Arrange the apparatus as shown in Fig.
2. Initially, keep each disc at a distance $a = 4$ cm from the center of the rod. Set the rod into small oscillations in the horizontal plane.
3. Measure the time taken for 20 oscillations thrice and calculate the mean time (t). Change the value of 'a' step by step.
4. For each value of a, measure the time for 20 oscillations twice and calculate the mean time (t).
5. Record all the readings in Observation Table and complete the table.
6. Plot the graphs using the readings, perform the necessary calculations and determine the results.

Results:

Young's modulus (Y) of the material of flat spiral spring = $Y = \underline{\hspace{2cm}}$ dyne/cm.

Oral questions

1. What is a flat spiral spring?
2. What is Young's modulus?
3. What type of deformation occurs in a flat spiral spring?
4. What is Hooke's law?

Experiment No. 6

VELOCITY OF SOUND USING KUNDT'S TUBE.

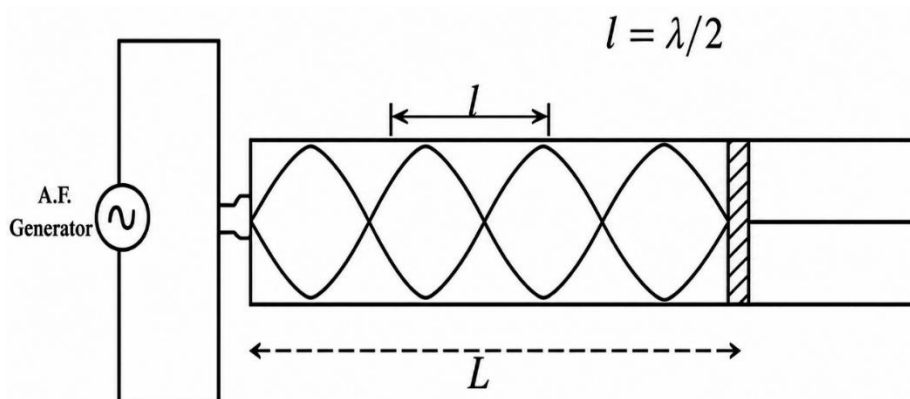
Aim:

To determine the velocity of sound in air using Kunt's tube.

Apparatus:

Kundt's tube, lycopodium powder, audio frequency oscillator, amplifier, speaker, meter scale, etc.

Diagram:



Experimental arrangement of Kundt's tube

Formula:

1. Velocity of sound at temp. t $V_t = n\lambda$
2. $V_t = V_0 \left(1 + \frac{\alpha t}{2}\right)$

Where,

V_t - Velocity of sound in air at $t^\circ\text{C}$

V_0 - Velocity of sound in air at 0°C

t - Room temperature

n - Frequency of wave from audio frequency generator

λ - Wavelength of wave

α - $0.00367/^\circ\text{C}$

Observations:

1. Room temperature = $t = \underline{\hspace{2cm}}^\circ\text{C}$
2. Fixed distance between piston and speaker(x) = $\underline{\hspace{2cm}}$ cm

Procedure:

1. Make the electrical connections and Exp.al arrangement as shown in Fig.
2. Set the frequency of the Audio Frequency Generator (AFG) to approximately 800 Hz. Adjust the position of the piston P to obtain a well-defined stationary wave pattern inside the Kundt's tube.

3. Determine the distance x between piston and speaker.
4. Calculate the wavelength and hence determine the velocity of sound V_t .
5. Record all observations in the observation table.
6. Increase the AFG frequency in steps of approximately 100 Hz and repeat the above procedure for each frequency.
7. Determine the corresponding values of V_t .
8. From the observation table, calculate the mean value of the velocity of sound, V_t .

Observation Table:

Obs. No.	Frequency of audio frequency generator n Hz	No. of loops 'P'	Length of loop $l = \frac{x}{p}$ cm	Wavelength $\lambda = 2l$ cm	Velocity of sound in air at room temperature $V_t = n\lambda$ cm/sec
1					
2					
3					
4					
5					

Calculations:

Result:

Velocity of sound,

1. In air $V_t =$ _____ cm/sec
2. at 0°C , $V_0 =$ _____ cm/sec

Oral questions:

1. What is Kundt's tube?
2. What is the principle of Kundt's tube Exp.?
3. What is the approximate velocity of sound in air at room temperature?
4. What is a node & antinode?

Experiment No. 7

FREQUENCY OF ELECTRICALLY MAINTAINED TUNING FORK BY MELDE'S EXPERIMENT

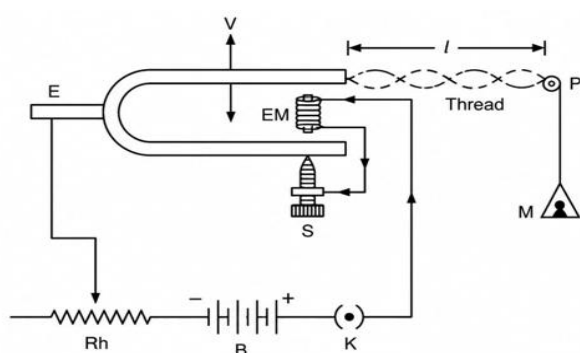
Aim:

To determine the frequency of electrically maintained tuning fork by Melde's Experiment.

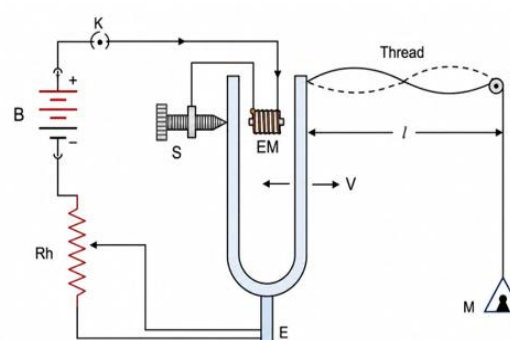
Apparatus:

Electrically maintained tuning fork, weight box, pan, balance, power supply, light weight string, stand, etc.

Diagram:



Transverse arrangement



Longitudinal arrangement

Formula:

$$1. T = Mg$$

2. For transverse mode

$$n = \frac{P}{2l} \sqrt{\frac{Mg}{m}}$$

3. For longitudinal mode

$$n = \frac{P}{l} \sqrt{\frac{Mg}{m}}$$

Where,

T- Tension in the string

M- Mass attached to string

n- Frequency of tuning fork

P- No. of loops

g- Acceleration due to gravity = 980cm/sec²

m- Mass per unit length

Observations:

1. Total length of the string = $L =$ _____ cm
2. Mass of the string = $m_s =$ _____ gm
3. Mass per unit length of the string = $m =$ _____ gm/cm
4. Mass of the pan attached to string = $m_p =$ _____ gm

Observation Table:

Mode of vibration	Mass in the pan m gm	Mass attached to the string $M = m + m_p$ gm	Tension $T = Mg$ dyne	No. of loops 'p'	Length of thread 'l' cm	Frequency 'n' Hz	Mean frequency 'n' Hz
Transverse							
Longitudinal							

Procedure:

For Transverse Arrangement

1. Set up the Experimental arrangement and make the electrical connections as shown in Fig. 1. Pass the string over the pulley as shown in figure.
2. Adjust the contact-point screw S until the tuning fork starts vibrating.
3. Obtain vibrations of maximum amplitude by adjusting either the mass attached to the thread or the vibrating length of the thread. Attach a mass M to the thread and adjust its length so that one loops are formed over a length l of the thread.
4. Record these values in observation table.
5. For each observation, determine the frequency (n).

For Longitudinal Arrangement

1. Set up the Experimental arrangement and electrical connections as shown in Fig. 2.
2. Repeat the procedures described transverse arrangement.
3. Record the corresponding observations observation table for longitudinal mode.

Calculations:

1. For transverse mode $n = \frac{P}{2l} \sqrt{\frac{Mg}{m}}$
2. For longitudinal mode $n = \frac{P}{l} \sqrt{\frac{Mg}{m}}$

Result:

1. For transverse mode

Frequency of electrically maintained tuning fork (n) = _____ Hz

2. For longitudinal mode

Frequency of electrically maintained tuning fork (n) = _____ Hz

Oral question

1. What is Melde's Exp.?
2. What is resonance?
3. What type of waves are produced in the string?
4. What is the main advantage of an electrically maintained tuning fork?

Major Practical V(a)

Group II

Experiment No. 1

CARDINAL POINTS BY TURN TABLE

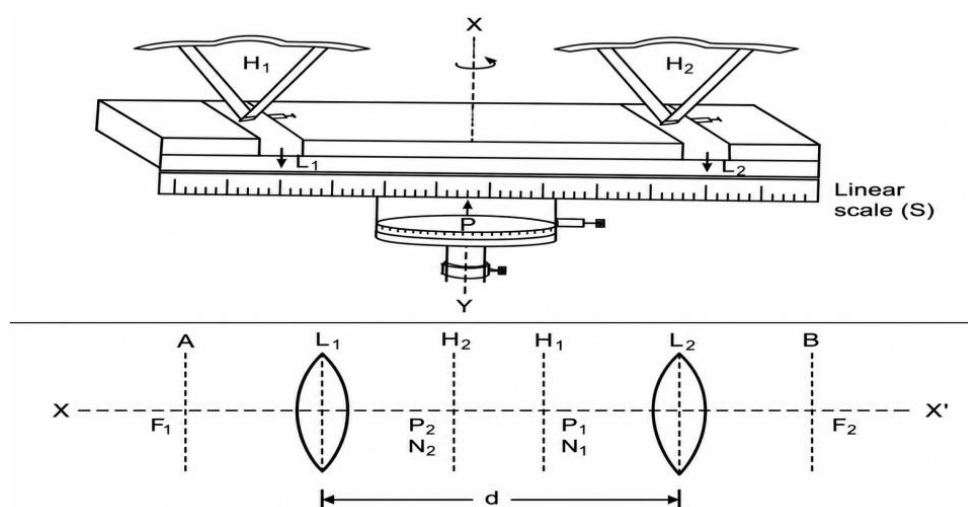
Aim:

To determine the cardinal points of an optical system by turn table.

Apparatus:

Convex lenses with holder, plane mirror, index pins, table lamp, thread, Meter scale etc.

Diagram:



Observations:

1. Focal length of lens $L_1 = f_1 =$ _____ cm.
2. Focal length of lens $L_2 = f_2 =$ _____ cm.

Formula:

$$\frac{1}{F} = \frac{1}{f_1} + \frac{1}{f_2} - \frac{d}{f_1 f_2}$$

Procedure:

1. Mount the two lenses L_1 and L_2 in their holders on as shown in figure.
2. Place the complete optical system on the turntable and make its principal axis coincide with the XX' axis.
3. Note the positions of L_1 and L_2 on the linear scale S .
4. Adjust the object and optical system so that a sharp image is obtained.
5. To locate the first nodal point N_1 , slightly rotate the optical system about the vertical axis YY' .

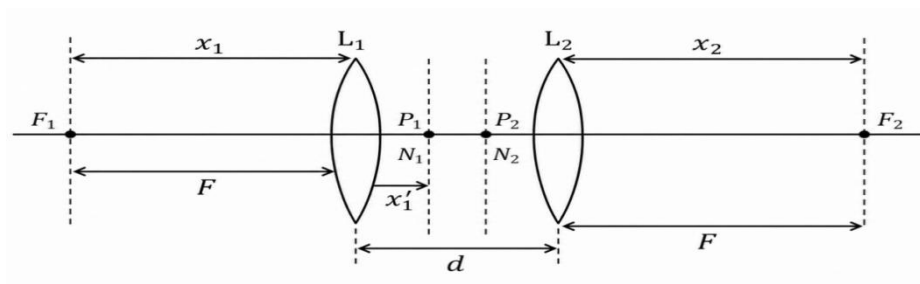
6. Observe the image. If the image moves laterally, shift the turntable/system along the optical bench and rotate it again.
7. Continue this process until rotation of the optical system produces no lateral displacement of the image.
8. The position of the turntable axis at this condition gives the position of the first nodal point N_1 .
9. Reverse the optical system and repeat the same procedure to determine the second nodal point N_2 .
10. Since the system is in air, take: $N_1 = P_1$, $N_2 = P_2$ Thus, the principal points are obtained.
11. Determine the first focal point F_1 by locating the position of the object for which the emergent rays become parallel.
12. Similarly, determine the second focal point F_2 by locating the position at which parallel incident rays are brought to focus.
13. Measure all the positions from the linear scale and calculate the focal lengths.

Observation Table:

Sr. No.	Distance between two lenses 'd' cm	Distance of image from first lens $x_1 = L_1 F_1$ cm	Distance of first plane from axis of rotation F_1 cm	Distance of images from second lens $x = L_2 F_2$ cm	Distance of second focal plane from axis of rotation F_2 cm
1.					
2.					

Calculation:

Plotting of cardinal points:



Result: The cardinal points are shown in the graph.

Oral Question:

1. What are the cardinal points of an optical system?
2. What is the unit of focal length?
3. Can parallax error be avoided?
4. What are the two nodal points?
5. What is the purpose of using a turn table in this Exp.?

Experiment No. 2

CARDINAL POINTS BY NEWTON'S METHOD.

Aim:

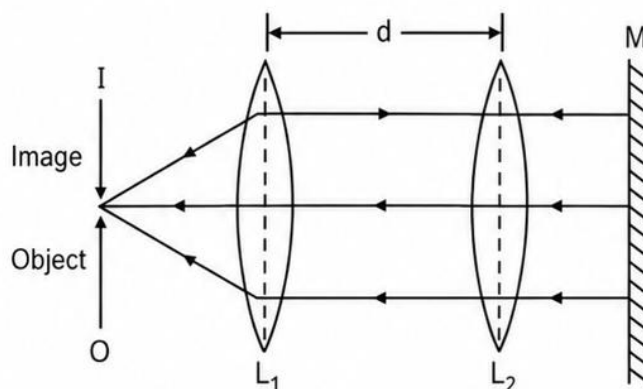
To determine the cardinal points by Newton's method.

Apparatus:

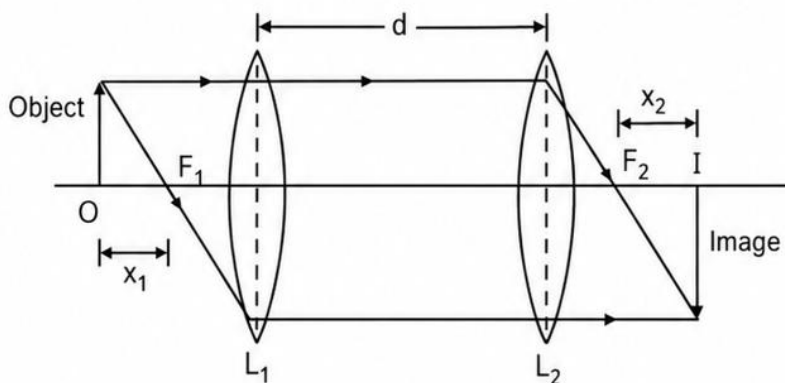
Plano-Convex lens with holder, plane mirror, index pins, table lamp, Lens stand, Meter scale etc.

Diagram:

(i) Auto-collimation :



(ii) Formation of an image of an object :



Procedure:

1. Select two convex lenses L_1 and L_2 of focal lengths f_1 and f_2 respectively.
2. Keep distance between two lenses d (say $d = 10$ cm).
3. Illuminate the object. Use auto-collimation method to find the focal point of the combination (adjust the lens system for parallel light) using mirror as shown in Fig. 2.1.
4. the object (O) on one side of lens system (say $L_1O = 10$ cm) (say beyond lens L_1) and find its image (I) position beyond lens L_2 (other of lens system). Note these distances

L_1O and L_2I . Also note the values of distances d_1 , $L_1 * F_1$, and $L_2 * F_2$. From these distances, find the values of X_1 , X_2 and F and write these values in the observation table-I (shown in Fig. 2.2). Repeat this procedure of calculating L_1O , L_2I and X_1 , X_2 , F for another value of L_1O (say $L_1O = 22$ cm).

5. Repeat the procedure in steps (2), (3) and (4) for another distance of separation (d) between lenses L_1 and L_2 (say $d = 12$ cm).
6. Use graph papers and show the position of cardinal points separately for (i) $d = 10$ cm and (ii) $d = 12$ cm as shown in Fig. 2.3.

Observation Table I:

For $L_1L_2 = d = \dots\dots\dots\text{cm}$, $L_1F_1 = \dots\dots\dots\text{cm}$, $L_2F_2 = \dots\dots\dots\text{cm}$

Obs. No.	L_1O cm	L_2I cm	$X_1=L_1O-L_1F_1$ cm	$X_2=L_2I-L_2F_2$ cm	$F = \sqrt{X_1X_2}$	Mean F
1						
2						

Observation Table II:

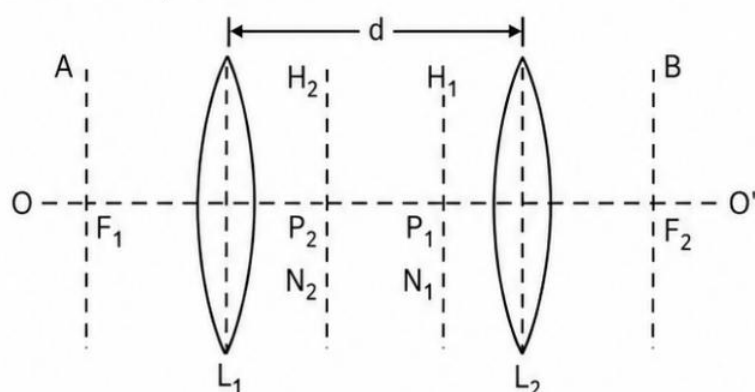
For $L_1L_2 = d = \dots\dots\dots\text{cm}$, $L_1F_1 = \dots\dots\dots\text{cm}$, $L_2F_2 = \dots\dots\dots\text{cm}$

Obs. No.	L_1O cm	L_2I cm	$X_1=L_1O-L_1F_1$ cm	$X_2=L_2I-L_2F_2$ cm	$F = \sqrt{X_1X_2}$	Mean F
1						
2						

Formula: $F = \sqrt{X_1X_2}$

Calculation:

Plotting of cardinal points:



Result: The cardinal points are shown in the graph.
Different distances are as follows:

Table I

1. Distance between first focal point (F_1) and lens $L_1 = L_1 F_1 =$ _____ cm.
2. Distance between first focal point (F_1) and lens $L_2 = L_2 F_2 =$ _____ cm.
3. Distance between lens L_1 first principal point = $L_1 P_1 =$ _____ cm.
4. Distance between lens L_1 second principal point = $L_2 P_2 =$ _____ cm.
5. Distance between lens L_1 and first nodal point = $L_1 N_1 =$ _____ cm.
6. Distance between lens L_1 and second nodal point = $L_2 N_2 =$ _____ cm.

Table II

1. Distance between first focal point (F_1) and lens $L_1 = L_1 F_1 =$ _____ cm.
2. Distance between first focal point (F_1) and lens $L_2 = L_2 F_2 =$ _____ cm.
3. Distance between lens L_1 first principal point = $L_1 P_1 =$ _____ cm.
4. Distance between lens L_1 second principal point = $L_2 P_2 =$ _____ cm.
5. Distance between lens L_1 and first nodal point = $L_1 N_1 =$ _____ cm.
6. Distance between lens L_1 and second nodal point = $L_2 N_2 =$ _____ cm.

Oral Question:

1. Mention different cardinal points.
2. Give importance of cardinal points.
3. Explain, auto collimation method.
4. In this Exp., why principal points and nodal points coincide?
5. What is focal length of a lens?

Experiment No. 3

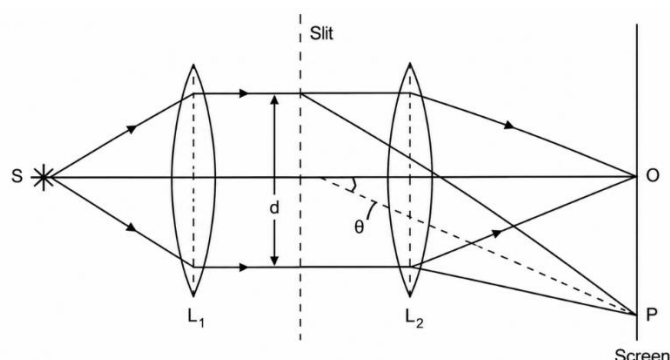
DIFFRACTION AT SINGLE SLIT

Aim:

To determine the wavelength of a given monochromatic source of light by diffraction at single slit.

Apparatus:

Spectrometer, prism, levelling bottle, sodium source, single slit, travelling microscope, reading lens etc.

Diagram:**Observations:**

1. L.C. of Spectrometer = _____ Cm.
2. Slit width (d) = _____ cm

Formula:

1. $e \sin \theta = n \lambda$
2. $\lambda = d \times \text{slope}$

Where, θ = Angle of diffraction e = Slit width n = Order of fringe.

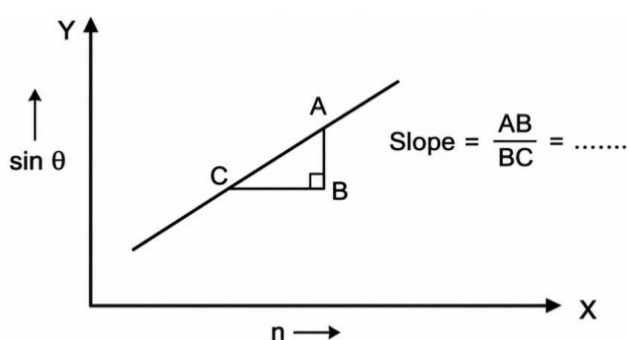
Procedure:

1. Illuminate the slit of the collimator of spectrometer with a monochromatic (Na) light. Find the least count of the spectrometer.
2. Adjust the collimator and telescope to the parallel light by using Schuster's method. Observe the collimator slit (image) in the telescope in direct position.
3. Place a single auxiliary slit between the collimator and the telescope.
4. Adjust the inclination and the width of the slit to get diffraction pattern on either side of the central maxima. In other words, dark fringes of different orders $n = 1, 2, 3, \dots$ etc. are produced on either side (L.H.S. and R.H.S.) of the central maximum.
5. Adjust the cross-wires of the telescope on these fringes in step (4) on both sides and record their readings through spectrometer window. Write these readings in the observation table.
6. Complete the observation table and find the mean value of $(\sin \theta / n)$. Also plot a graph between $\sin \theta$ and n from the observation table and find its slope. Measure slit width (d) using the travelling microscope.

Observation Table:

Obs. No.	Order of fringe (n)	Spectrometer reading (Degree)		Difference $2\theta = x - y$ degree	Angle θ degree	$\sin\theta$	$\frac{\sin\theta}{n}$
		L.H.S. (x)	R.H.S. (y)				
1							
2							
3							
4							
5							

Graph: Plot a graph of $\sin\theta$ vs n.



Calculation:

Result:

1. The wavelength of the given source of light using mean value is = _____ Å.
2. The wavelength of the given source of light using slope = _____ Å.

Oral Questions

1. What is diffraction of light?
2. What is a monochromatic source of light?
3. What is the SI unit of wavelength?
4. Why is a convex lens used in the Exp.al setup?
5. What is the relation between wavelength, slit width and diffraction angle?

Experiment No. 4

DETERMINATION OF CAUCHY'S CONSTANTS

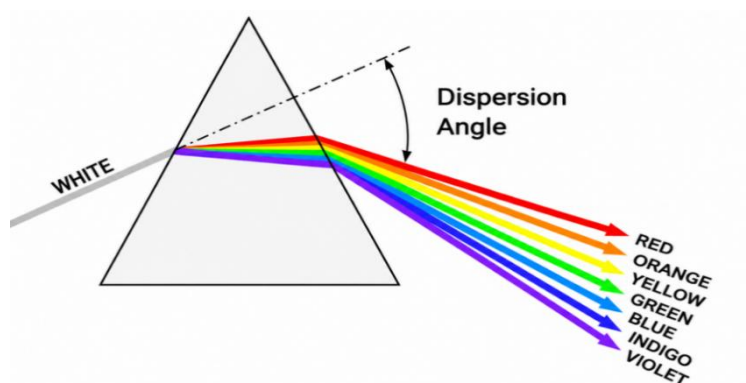
Aim:

To determine the value of Cauchy's constants A and B for a material of given prism.

Apparatus:

Prism, mercury vapour lamp, spectrometer, levelling bottle, reading lens etc.

Diagram:



Procedure:

1. Level the spectrometer properly using the levelling screws.
2. Adjust the telescope and the collimator to obtain a sharp image of the slit.
3. Place the prism properly on the prism table.
4. Illuminate the slit using a mercury vapour lamp.
5. Observe the spectrum produced by the prism through the telescope.
6. Rotate the prism and telescope to obtain the position of minimum deviation for a particular spectral line.
7. Record the readings of the telescope at the position of minimum deviation.
8. Repeat the procedure for different prominent spectral lines of the mercury vapour lamp.
9. Note the wavelength λ corresponding to each spectral line.
10. Calculate the minimum deviation θ_m for each spectral line.
11. Calculate the refractive index μ for each wavelength using the formula:

$$\mu = \left(\frac{\sin\left(\frac{A + \theta_m}{2}\right)}{\sin\left(\frac{A}{2}\right)} \right)$$

Where, A is the angle of the prism.

12. For each spectral line calculate the value of: $\frac{1}{\lambda^2}$
13. Plot a graph between μ and $\frac{1}{\lambda^2}$

14. Determine the values of Cauchy's constants using Cauchy's equation:

$$\mu = A + \left(\frac{B}{\lambda^2}\right)$$

15. The intercept on the μ axis gives the value of constant A.

16. The slope of the graph gives the value of constant B.

Observation:

1. L. C. of spectrometer = _____ min
2. Angle of Prism = 60°

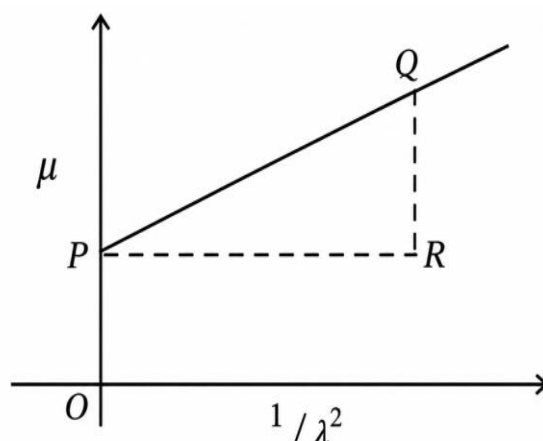
Formula:

Cauchy's equation: $\mu = A + \left(\frac{B}{\lambda^2}\right)$

Observation Table:

Sr. No.	Colour	Wave-length λ $\text{\AA}$	Spectrometer Reading		Minimum deviation $\theta_m = \theta_1 - \theta_2$	μ	$\frac{1}{\lambda^2}$ $\frac{1}{\text{\AA}^2}$
			θ_1	(Direct reading) θ_2			
1							
2							
3							
4							
5							
6							
7							

Graph: Plot a graph of θ_m vs $\frac{1}{\lambda^2}$



1. Intercept OP = A = _____
2. Slope QR/PR = B = _____ ($\text{\AA}^2$)

Calculation:

Result:

Cauchy's Constants

1. $A =$ _____
2. $B =$ _____ (Å)

Oral Question

1. What is Cauchy's dispersion formula
2. Why is a prism used in this Exp.?
3. What is Cauchy's dispersion formula?
4. What is the refractive index of a material?
5. What is meant by least count of a spectrometer?

Experiment No. 5

Diffraction at Cylindrical obstacle

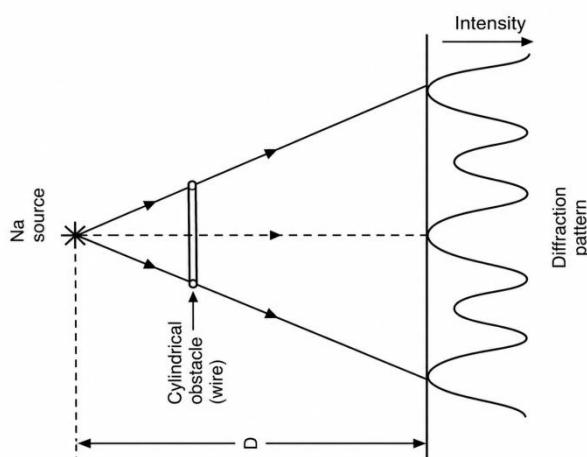
Aim:

To determine the wavelength of a given monochromatic source of light by diffraction at cylindrical obstacle.

Apparatus:

Optical bench with four upright holders, cylindrical obstacle, micrometre screw gauge, meter scale, monochromatic source, reading lens etc.

Diagram:



Procedure:

1. Make adjustments of the optical bench. Place cylindrical obstacle (wire or pin) between source S and eyepiece (screen) and towards the source. Measure width (c) of the cylindrical obstacle.
2. Turn the Na-source ON and make the optical alignment so that the geometrical shadow of the cylindrical obstacle is seen in the eyepiece with its length vertical. Measure the distance D of the screen from the source.
3. Adjust the slit width of the source to see diffraction fringes of straight-line nature (shape) in the eyepiece.
4. Take the micro meter reading (X) for each fringe. Record the readings.
5. Plot a graph between X and n. From the slope, find the value of wavelength λ of the given monochromatic source. Write the result.

Observations:

1. L. C. of micrometre screw gauge = _____ cm
 2. Diameter of cylindrical obstacle: a. = _____ cm, b. = _____ cm, c. = _____ cm
- Mean diameter of cylindrical obstacle (d) = _____ cm

3. Bench error (given) (e) = _____ cm
4. Observed distance between obstacle and focal plane of eye piece (D1) = _____ cm
5. Corrected distance between obstacle and focal plane of eye piece =
 $D = D1 - e =$ _____ cm

Formula:

$$\lambda = \frac{x d}{D}$$

Where, λ = Wavelength of light, x = Mean fringe width

Observation Table:

L.C of Micro-meter: _____ cm

Sr. No.	Fringe number n	Micro-meter Reading		Total Reading (cm)	Fringe Width (X) (cm)	Mean Fringe Width (X) (cm)
		Main Scale (cm)	Division on circular scale			
1						
2						
3						
4						
5						

Calculation:

Result: The wavelength of monochromatic source of light is = _____ A

Oral Question:

1. What is diffraction of light?
2. Which quantities are measured Exp.ally?
3. What is the SI unit of wavelength?
4. What type of diffraction occurs in this Exp.?
5. What is the difference between interference and diffraction?

Experiment No. 6

Verification of Malus' Law Using Polarized Light

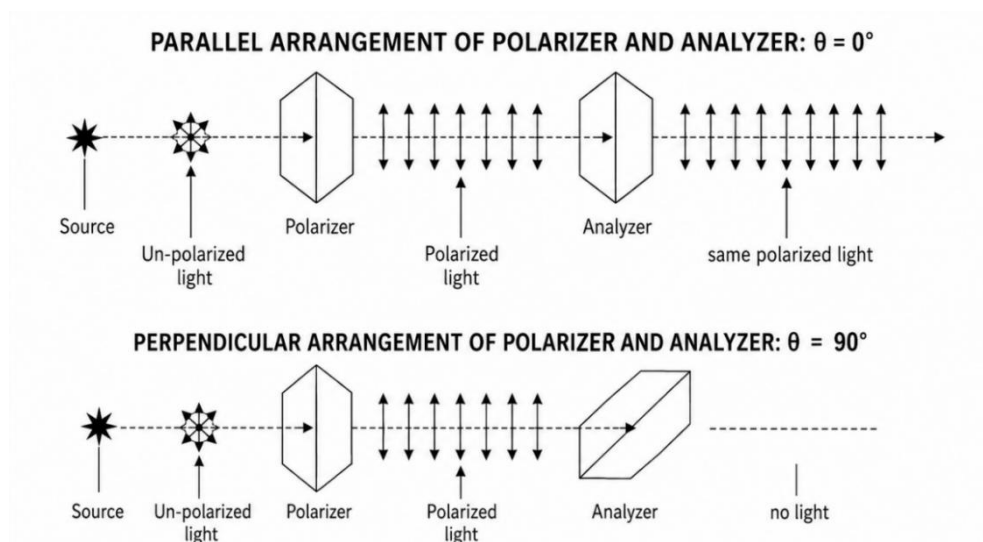
Aim:

To verify Malus's law which states that the intensity of polarized light transmitted through an analyser varies as the square of the cosine of the angle between the transmission's axes of the polarizer and analyser.

Apparatus:

Light source, Two Polaroid sheets (Polarizer and Analyser), photodiode detector with micro ammeter/Lux meter, Rotating mount with angular scale.

Diagram:



Formula:

$$I = I_0 \cos^2 \theta$$

Where, I = intensity of light transmitted by analyser.

I_0 = Maximum intensity of light transmitted by analyser.

θ = Angle between the transmission axes between the polarizer and analyser.

Procedure:

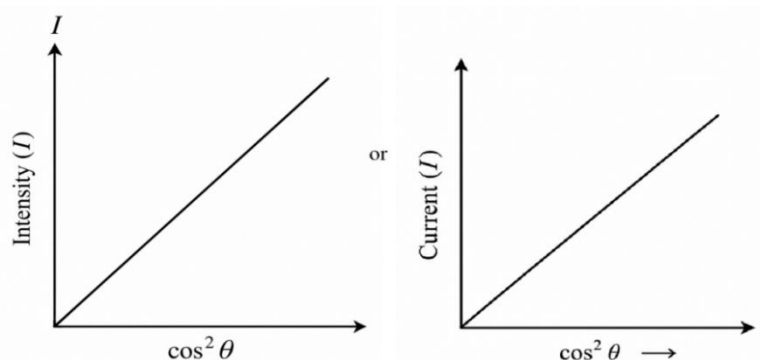
1. Arrange the light source, polarizer, analyser and photodetector (lux meter/ammeter) in a straight line.
2. Ensure that the light passes through the centre of both the polarizer and analyser before reaching the photodetector (lux meter/ammeter).
3. Fix the polarizer in a stationary position throughout the Exp.
4. Rotate the analyser until the detector shows the maximum intensity. At this position, the transmission axes of the polarizer and analyser are parallel.
5. Set this position as 0° on the angular scale of the analyser.
6. Record the maximum intensity I_0 displayed by the photodetector (lux meter/ammeter).

7. Rotate the analyser by 10° intervals and record the corresponding intensity/current for each angle.
8. Continue taking readings at regular intervals from 0° to 90° , ensuring that the polarizer remains fixed.
9. For each angular position, calculate the values of $\cos \theta$ and $\cos^2 \theta$.
10. Plot a graph of Intensity (I) versus $\cos^2 \theta$ or current (I) versus $\cos^2 \theta$. A straight-line graph passing through the origin confirms Malus' Law.

Observation Table:

Sr. No.	Angle θ ($^\circ$)	$\cos \theta$	$\cos^2 \theta$	Intensity by luxmeter (I) or Current by the ammeter (I)
1	0°			
2	10°			
3	20°			
4	30°			
5	40°			
6	50°			
7	60°			
8	70°			
9	80°			
10	90°			

Graph:



Result: The intensity of the transmitted plane-polarized light is found to vary as the square of the cosine of the angle between the transmission axes of the polarizer and analyser, i.e., $I = I_0 \cos^2 \theta$. Hence, Malus' Law is verified within the limits of Experimental error.

Oral Question:

1. What is polarization of light?
2. What is the difference between a polarizer and an analyser?
3. What are the practical applications of polarized light?
4. Why is intensity proportional to the square of the electric field?
5. What happens if the analyser is removed?

Experiment No. 7 SPHERICAL ABERRATION

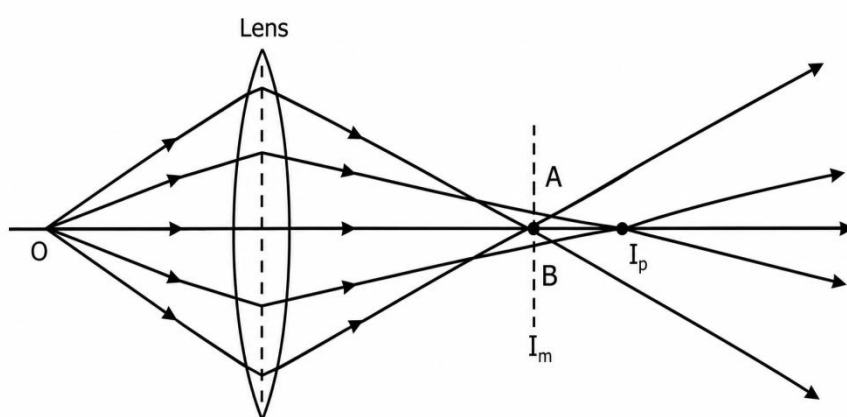
Aim:

To plot the caustic curve for the given thick lens and then to determine the ratio of the transverse spherical aberration for the extreme ray to the radius of the circle of last confusion.

Apparatus:

A thick lens of large aperture, point source of light (12-volt bulb), semi-transparent screen, metre scale etc.

Diagram:



Procedure:

1. Arrange the point source of light, thick lens and semi-transparent screen along the same principal axis.
2. Place the thick lens vertically on the optical bench and illuminate it with the point source of light.
3. Place the semi-transparent screen on the other side of the lens and adjust its position to obtain a circular spot of light.
4. Measure the distance D between the lens and the screen using a metre scale and record it in the observation table.
5. Measure the diameter d of the circular spot formed on the screen and record the value.
6. Calculate the radius of the circular spot using

$$r = \frac{d}{2}$$

7. Move the screen gradually along the principal axis and repeat the measurements of D and d for different positions of the screen.
8. Record at least ten sets of observations in the observation table.
9. Plot the graph of the radius of the circular spot r against the distance D to obtain the caustic curve.

10. From the caustic curve, locate the circle of least confusion and determine its radius GF' .
11. Determine the transverse spherical aberration LL' corresponding to the extreme ray from the caustic curve.
12. Calculate the ratio of transverse spherical aberration of the extreme ray to the radius of the circle of least confusion using

$$\text{Transverse aberration: } \frac{\text{Transverse spherical aberration}}{\text{Radius of circle of least confusion}} = \frac{LL'}{GF'}$$

13. Record the calculated value and state the result.

Observation:

1. Transverse aberration: $\frac{\text{Transverse spherical aberration}}{\text{Radius of circle of least confusion}} = \frac{LL'}{GF'}$

Observation table:

Obs. No.	1	2	3	4	5	6	7	8	9	10
Distance Between lens and screen 'D' cm										
Diameter of the circular spot on the screen 'd' cm										
Radius of the spot $r = \frac{d}{2}$ cm										

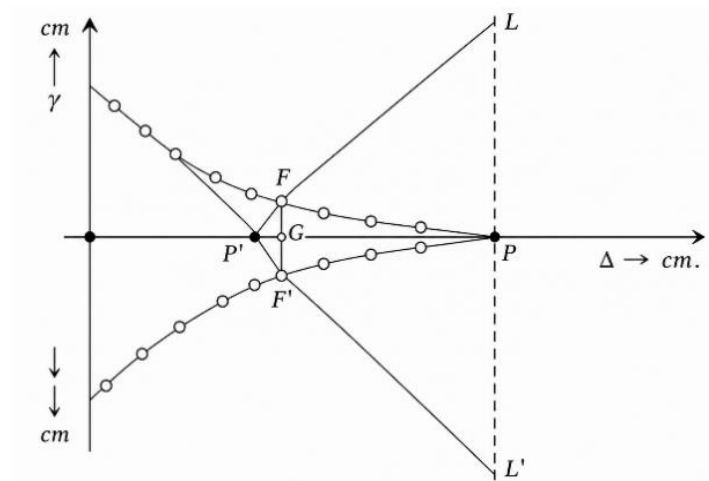
Calculation:

Transverse spherical abortion = $LL' = \text{----- cm}$

Radius of curve of least confusion = $GF = GF' = \text{----- cm}$

$$\text{Transverse aberration: } \frac{\text{Transverse spherical abortion}}{\text{radius of circle of least confusion}} = \frac{LL'}{GF'}$$

Nature of graph: Plot a graph of D vs r . The nature of graph is as below.



Result: The transverse spherical aberration is = _____

Oral Question

1. What is spherical aberration?
2. What is a caustic curve in the study of spherical aberration?
3. What is meant by the circle of least confusion?
4. How is the radius of the circular spot calculated from its diameter?
5. How is the ratio of transverse spherical aberration to the radius of the circle of least confusion determined Exp.ally?

Major Practical V(b)

Group I

Experiment No. 1

SELF-INDUCTANCE BY OWEN'S BRIDGE

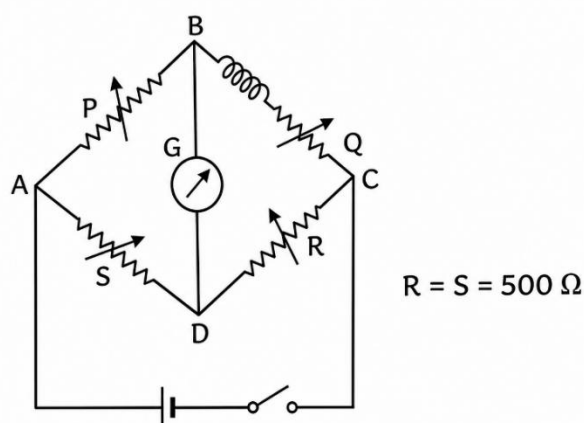
Aim:

Use of Owen's bridge to find self-induction in terms of standard resistances and capacitances.

Apparatus:

Resistance box, Condenser, Unknown inductance, head phone, frequency generator, cell key, connecting wire etc.

Circuit Diagram:

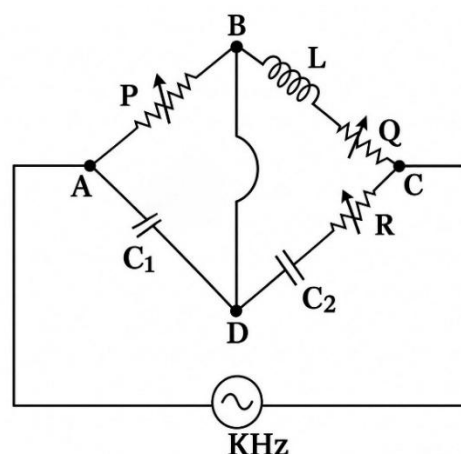


Circuit I for D.C Balance

In fig. P, Q, R, S = Resistance box

G = Galvanometer

E = Battery cell



Circuit II for A.C

K= cell Key

F. G.= Frequency generator

Rh= Rheostat

Formula:

In A. C Balance Fixed Inductance

$$L = PRC$$

Where, P & R – Resistances in ohm

c- Capacity in farad

here $C_1 = C_2 = 0.1 \mu\text{F}$ are standard condenser of equal value

L- Self-inductance of a given coil.

Procedure:

1. Connect the circuit as shown in circuit diagram

2. For D. C. Balance Keep resistance same values ($R = S$) in ohms
3. Take the value of resistance in P in the choice. Then adjust the value of resistance Q to obtain null deflection in the galvanometer G. Record these values of resistances P, S, R and Q in the observation table-I.
4. Repeat the procedure in next step for different values. From table-I
5. Connect the circuit given in circuit-II.
6. For each value of resistance P and resistance Q noted in the observation table-I, find the corresponding value of resistance R to obtain the minimum sound in the head phone (null point). Record these values of resistances P, Q and R in the observation table-II.
7. From this table find the mean value of self-inductance (L) of a given coil.

Observation Table:

1. For D.C Balance

Obs. No.	P Ω	Q Ω	R Ω	S Ω
1				
2				
3				
4				
5				

2. For A.C Balance

Obs. No.	P Ω	Same as for D. C balance Q Ω	R Ω	$L = \frac{P R C}{H}$
1				
2				
3				
4				
5				

Calculations:

Result:

Self-inductance using Owen's Bridge = _____ H

Oral question:

1. What is Owen's Bridge?
2. What is the principle of Owen's Bridge?
3. What is self-inductance?
4. What are the advantages of Owen's Bridge?

Experiment No. 2

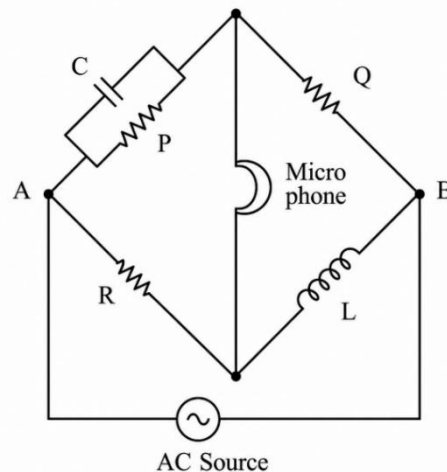
SELF-INDUCTANCE BY MAXWELL'S BRIDGE MARKS

Aim:

To determine the self-inductance & inductor by maxwell bridge

Apparatus:

Rheostat, resistance boxes, battery cell, galvanometer, inductance coil, capacitors, head phone, frequency generator, capacitances decade box, connecting wires etc.

**Formula:**

Self-Inductance of coil $= L = CRQ$

Where, L = Self-inductance of the coil (henry)

C = Capacitance of the condenser (farad)

R = Resistance of the resistor R (ohm)

Procedure:

1. Connect the Maxwell's Bridge circuit carefully as shown in the circuit diagram, making sure that all connections are tight and properly connected.
2. Connect the unknown inductance coil in the appropriate arm of the bridge and the standard capacitor in its designated position.
3. Connect the AC signal generator (1 kHz) across the bridge supply terminals and connect the null detector (headphones) across the detector terminals.
4. Switch on the AC supply and adjust the output to a suitable voltage.
5. Keep the values of Q and R fixed and vary the resistance P until the detector indicates a minimum response (null point).
6. At bridge balance, note the values of P , Q and R carefully.
7. Repeat the Exp. for at least four different values of P , while maintaining bridge balance each time.
8. Record all observations systematically in the observation table.
9. Calculate the self-inductance of the unknown coil using, $L = CRQ$.

Observation:

The capacitance of the condenser (C) = _____ F.

Observation Table:

Obs. No.	P (Ω)	Q (Ω)	R (Ω)	L = CRQ (H)	Mean L (H)
1					
2					
3					
4					

Calculations:

Result: Self-inductance of given coil L = _____ mH

Oral questions:

1. What is self-inductance?
2. State Faraday's law of electromagnetic induction.
3. What is Maxwell's Bridge?
4. Why is AC used instead of DC in Maxwell's Bridge?
5. What is the principle of bridge balance?

Experiment No. 3

MEASUREMENT OF LOW RESISTANCE BY CAREY-FOSTER'S BRIDGE

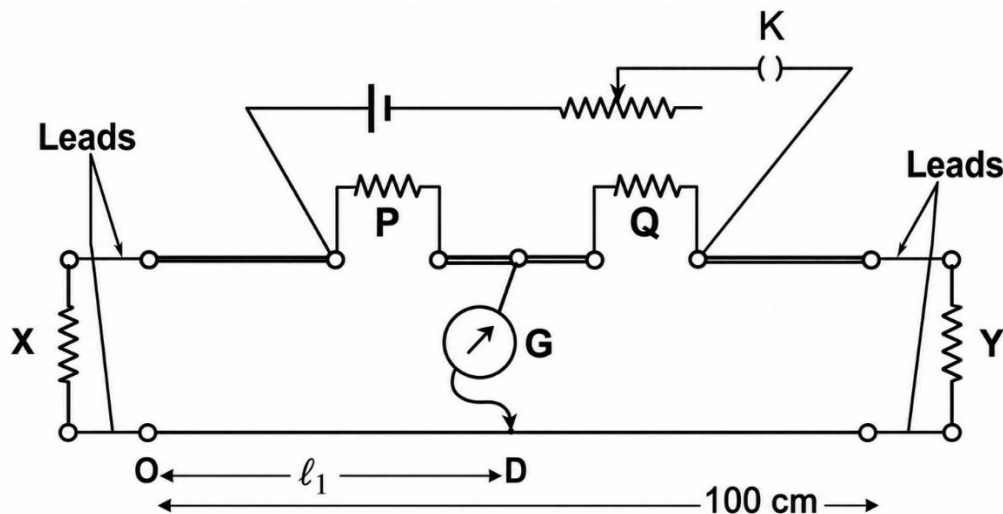
Aim:

To determine the resistance per length of the given bridge wire and also determine the unknown low resistances X and Y by using Carey Foster's key.

Apparatus:

Meter Bridge, Carey Foster key, rheostat, fractional resistance box, battery cell, key, galvanometer, connecting wires etc.

Circuit Diagram:



Formula:

- Resistance per unit length of wire of bridge $\rho = \frac{X}{l_2 - l_1}$
where, X = Known resistance (Ω),
 l_1 = First balance length (cm)
 l_2 = Second balance length (cm)
- Unknown resistance of the given wire / resistance $Y = X - (l_2 - l_1) \rho$

Procedure:

The Exp. is carried out in two parts:

Part A: To Determine the Resistance per Unit Length of the Bridge Wire

- Connect the circuit as shown in the Exp.al setup.
- Connect the galvanometer to the bridge.
- Select a known resistance X using the resistance box (band switches) on the left side.
- Set the resistance $Y = 0 \Omega$ on the right side.
- The terminals P and Q are already connected internally; therefore, no additional connection is required.
- Connect the bridge to the AC mains supply and switch it ON using the power switch.

7. Press the jockey key and slowly slide the jockey along the bridge wire to locate the position where the galvanometer shows zero (or minimum) deflection.
8. Note the balance length l from the left end of the bridge wire using the meter scale.
9. Interchange the resistances by setting $X = 0 \Omega$ on the left side and selecting the same resistance value on the right side.
10. Again, slide the jockey to obtain the null point and note the new balance length l_2 .
11. Calculate the resistance per unit length of the bridge wire), Repeat the Exp. for different values of X and calculate the average value of ρ .

Part B: To Determine the Resistance of the Given Wire (Unknown Resistance)

1. Connect the unknown resistance (or the given wire) to the Y terminal on the right side of the bridge.
2. Select a suitable known resistance X using the resistance box on the left side.
3. Switch ON the bridge and locate the null point by sliding the jockey while pressing the jockey key.
4. Record the first balance length l_1 .
5. Interchange the resistances and again locate the null point.
6. Record the second balance length l_2 .
7. Calculate the unknown resistance Y
8. Repeat the Exp. with different values of X

Observations Table:

1. To determine the resistance per unit length of the bridge wire:

Sr. No.	Known Resistance X (Ω)	Balance Length l_1 (cm)	Balance Length l_2 (cm)	$l_2 - l_1$	$\rho = \frac{X}{l_2 - l_1}$
1					
2					
3					

2. For resistance of given wire / unknown resistance:

Sr. No.	Known Resistance $X (\Omega)$	Balance Length l_1 (cm)	Balance Length l_2 (cm)	$l_2 - l_1$	$Y = (X - l_2 - l_1) \rho$
1					
2					
3					

Calculation:

Result:

- Resistance per unit length $\rho =$ _____ Ω/cm
- Unknown resistance $X =$ _____ Ω
 $Y =$ _____ Ω

Oral Questions:

- What is Carey-Foster's bridge?
- What is the difference between Carey-Foster's bridge and Wheatstone bridge?
- What is the role of the galvanometer?
- What is the main advantage of Carey-Foster's bridge?

Experiment No. 4

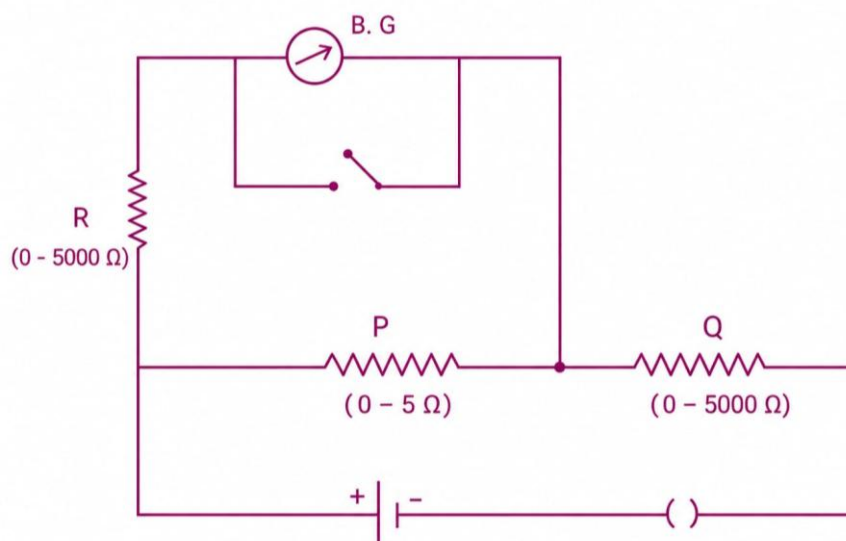
RESISTANCE OF BG BY HALF DEFLECTION METHOD

Aim:

To determine the resistance of B. G. by half deflection method

Apparatus:

Resistances box, Lamp & scale arrangement, B. G., single key, Tap Key, battery cell, B. G., connecting wire

Circuit Diagram:**Procedure:**

1. Set Ballistic galvanometer and its lamp and scale arrangement.
2. Connect the circuit as shown in circuit diagram.
3. Place the key K after keeping resistance Q will be high (about 1000 to 10000) and P low ($P = 0$).
4. Now make resistance P = very small will be chose and resistance Q = constant ($Q = 1000 \Omega$ to 10000Ω). Also keep the resistance $R = 0$. Keep the resistance Q constant throughout the Exp..
5. Record these values of P and the corresponding steady deflection (d). Now adjust the value of resistance R to get half the earlier deflection ($d/2$). This value of R is nothing but the resistance of B.G. (G). Record these values in the observation table.
6. Repeat the procedure in the above step (4) for other values of P Find the mean value of R or G

Observation Table:

Obs. No	Resistance P Ω	Resistance Q Ω	Deflection of spot when R=0	Value of R to get half deflection R = G (Ω)
1				
2				
3				
4				
5				
Mean value of R = G = _____ Ω				

Calculations:

Result: Resistance of B.G. = G = _____ Ω

Oral questions:

1. What is B. G.?
2. Explain the procedure of the Exp.
3. Which resistances in the circuit is varied to get half deflection
4. Explain the principle of B.G.

Experiment No. 5

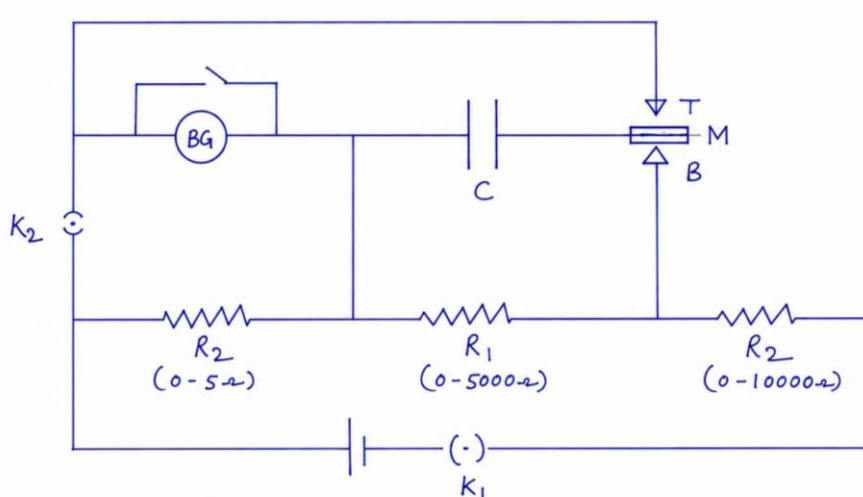
ABSOLUTE CAPACITY OF CONDENSER USING B. G.

Aim:

To determine absolute value of capacity of condenser using B. G.

Apparatus:

Condenser, resistance box, B. G., Charge discharging Key, battery cell, single key, tap key, connecting wire.

Circuit diagram:**Formula:**

$$C = \frac{T}{2\pi} \frac{1}{GR_1} \frac{r}{\phi} \theta \left(\frac{\theta^1}{\theta_3} \right)^{\left(\frac{1}{4} \right)}$$

Where,

T = Time period of B.G.

ϕ = Steady deflection of B. G.

G = Resistance of galvanometer

C = Unknown capacitor

Procedure:

1. Set the ballistic galvanometer and its lamp and scale arrangement.
2. Connect the connections as per circuit diagram
3. Send momentary small current through B. G. & measure the time for ten oscillations (t) of B.G. From that calculate time period
4. Keep $r = 0 \Omega$, $R_2 = 10000 \Omega$, $R_1 = 500 \Omega$
5. Close the Key K_1 only and charge the capacitor C using press the charge discharge key

6. Release the charge discharge key so that the capacitor C discharges through B.G. hence gives the deflections to give the first throw Θ_1 and next throw on the same side of the scale Θ_3 . Note the above Θ_1 & Θ_3 .
7. Now Close the Key K_1 & key K_2 then vary the value of resistance r in very small range Ω & note down the corresponding steady deflection $\emptyset$ of B. G.
8. Plot the graph and Do calculations using formula

Observations:

1. Resistance of Galvanometer $G = \text{_____} \Omega$
2. Time for 10 oscillations of B. G.
 $t_1 = \text{_____} \text{ sec}, t_2 = \text{_____} \text{ sec}, t_3 = \text{_____} \text{ sec}$
3. Mean time for 10 oscillations
 $t = \text{_____} \text{ sec}$
4. Time period of B.G.

$$T = \frac{t}{10} = \text{_____} \text{ sec}$$

Observation Table:

Part I:

Keep $R_2 = 10,000 \Omega$, $R_1 = 500 \Omega$

Close K_1 only

Obs. No.	Successive discharge throws on the same side of B. G. when discharge key is released	
	θ_1	θ_3
1		

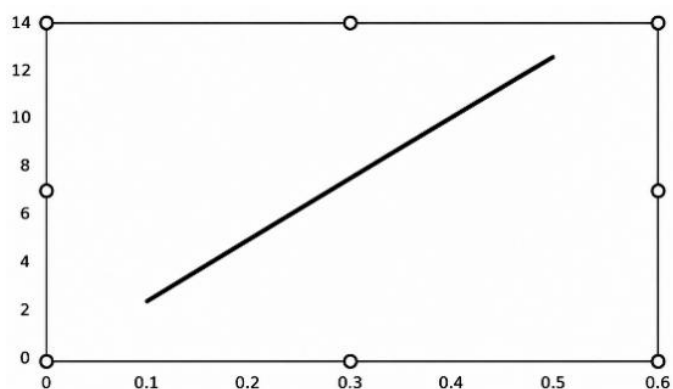
Part II:

Close K_1 & K_2 key

Obs. No.	Shunt Resistance R	Steady deflection $\emptyset$
1		
2		
3		
4		
5		

Graph Nature:

Plot the graph of r (y axis) vs ϕ (x axis)



Calculation:

Result:

Absolute value of capacity of condenser = $C =$ _____ . μF

Oral questions:

1. What is condenser?
2. What are different types of capacitors?
3. What is reactance of a capacitor?
4. Explain the function of key using in B.G.

Experiment No. 6

HIGH RESISTANCE BY LEAKAGE METHOD USING BG

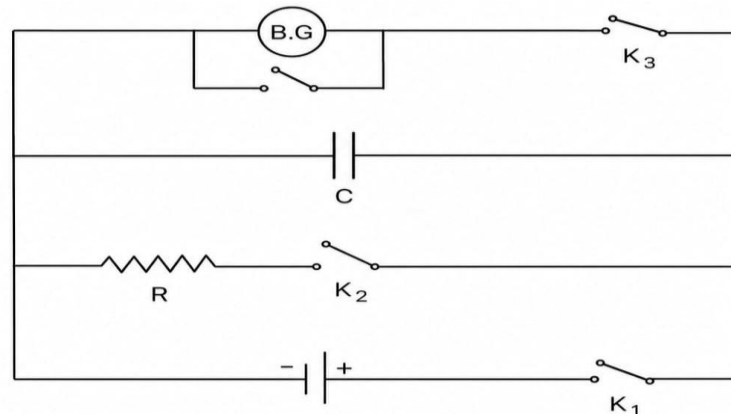
Aim:

To determine the given high resistance by the method of leakage using BG.

Apparatus:

B.G, Capacitor, Battery, high resistance, tap keys etc.

Circuit Diagram:



Formula:

$$R = \frac{1}{2.303 \times C} \left(\frac{t}{\log_{10} \left(\frac{\Phi_0}{\Phi} \right)} \right)_{mean}$$

$$R = \frac{1}{2.303 \times C} \times Slope$$

Procedure:

1. Make the connections according to the given circuit diagram.
2. Charge the capacitor: Connect the capacitor to the battery and charge it completely. After the capacitor is fully charged, disconnect it from the battery.
3. Connect the charged capacitor to the B.G. momentarily. Note the first throw shown by the B.G. on the scale. This throw is called Φ_0 .

Record the value in cm.

For example:

- For $1 \text{ M}\Omega$: $\Phi_0 = \underline{\hspace{2cm}}$ cm
- For $10 \text{ M}\Omega$: $\Phi_0 = \underline{\hspace{2cm}}$ cm

Note: Take the first throw quickly because the capacitor starts discharging as soon as the leakage path is connected.

4. Now connect the charged capacitor to the given high resistance. The capacitor will discharge slowly through the high resistance. Start the stopwatch at the same time.
5. Measure the leakage time Allow the capacitor to leak for a measured time t seconds. After the selected time, disconnect the leakage resistance and immediately connect the capacitor to the B.G. Note the first throw Φ in cm.

6. Repeat the measurement Repeat the Exp. for different leakage times. For every time, note the B.G. first throw three times and calculate the mean value.
7. Calculate the required values from the formula

Observations:

Throw of B.G on scale when capacitor is fully charged (Φ_0).

For $1\text{M}\Omega =$ _____ cm

For $10\text{M}\Omega =$ _____ cm

Observation table:

Obs. No.	Leakage Time(t) sec	First Throw(Φ)cm				$\text{Log}_{10} (\Phi_0/\Phi)$	$\frac{t}{\text{Log}_{10} (\frac{\Phi_0}{\Phi})}$
		1	2	3	Mean		
Mean:							

Calculations:

Result:

1. High Resistance (R) in $\text{M}\Omega$

By Calculation = _____

Oral Question:

1. What is the principle of the leakage method?
2. What is the function of the capacitor in this Exp.?
3. Why is a high resistance difficult to measure directly using an ammeter and voltmeter?
4. What is meant by high resistance?

Experiment No. 7

MEASUREMENT OF DIELECTRIC CONSTANT OF A GIVEN MATERIAL

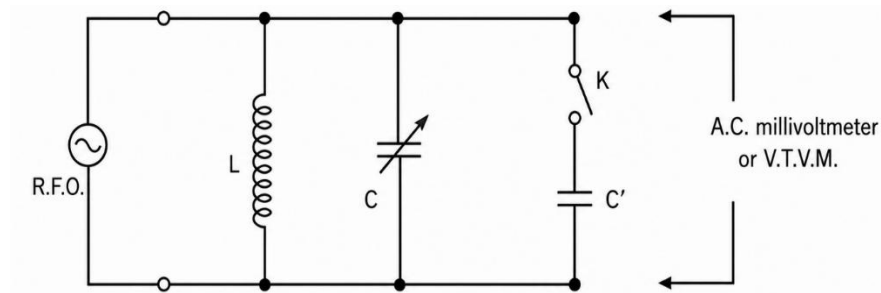
Aim:

To determine the dielectric constant (k) of a solid dielectric material and its polarizability by the resonance method.

Apparatus:

Radio Frequency Oscillator (R.F.O.), Variable capacitor (50-500 pF), Circular parallel, plate capacitor, Dielectric disc, V.T.V.M. / A.C. millivoltmeter, Inductance coil (L), Connecting wires.

Circuit Diagram:



Formulae:

Dielectric Constant

$$k = \frac{C_1 - C_2}{C_1 - C_3}$$

where, C_1 = Resonance capacitance with capacitor C alone

C_2 = Resonance capacitance with dielectric inserted

C_3 = Resonance capacitance without dielectric

Polarizability

$$N\alpha = \frac{3(k - 1)}{k + 2}$$

Procedure:

1. Switch ON the R.F. oscillator.
2. Check resonance over the complete frequency range.
3. Keep key K open so capacitor C' remains disconnected.
4. Select a suitable frequency.
5. Adjust capacitor C until maximum voltmeter reading (resonance) is obtained.
6. Record the capacitor reading as C_1 .
7. Close key K and insert the dielectric specimen.
8. Again, obtain resonance and note the capacitor reading as C_2 .
9. Remove the dielectric carefully without disturbing plate spacing.
10. Obtain resonance again and note the capacitor reading as C_3 .
11. Repeat the observations for at least three different frequencies.
12. Calculate the dielectric constant and polarizability.

Observation Table:

Obs. No.	Frequency of R. F. O. (Hz)	Values of variable capacitors C at resonance when			Dielectric Constant $k = \frac{C_1 - C_2}{C_1 - C_3}$	Mean k
		K-Open C alone	K-Closed (C & C' in circuit)			
			C' with dielectric	C' without dielectric		
		C_1 (pF)	C_2 (pF)	C_3 (pF)		
1						
2						
3						

Calculation:

1. Dielectric constant $k = \frac{C_1 - C_2}{C_1 - C_3}$

2. Polarizability $= N\alpha = \left(\frac{3(k-1)}{(k+2)} \right)$

Result:

1. The dielectric constant of the given dielectric specimen is $k =$ _____.
2. The polarizability of the dielectric specimen is $N\alpha =$ _____.

Oral questions:

2. What is meant by dielectric constant?
3. Why is resonance used in this Exp.?
4. What is the function of the RF oscillator?
5. Why should the dielectric be removed without disturbing the plate spacing?
1. What is polarizability and how is it related to dielectric constant?

Major Practical V(b)

Group II

Experiment No. 1 LOGIC GATES

Aim:

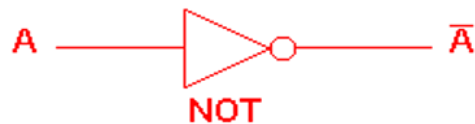
To verify the truth tables of NAND, NOR, Ex-OR and Ex-NOR gates by using basic gates with IC-74series.

Apparatus:

IC 7402, IC 7404, IC 7408, IC 7432, connecting wires, power supply, etc.

Diagrams:

1. NOT Gate



A	Y=A
0	1
1	0

2. OR Gate



A	B	Y = A.B
0	0	0
0	1	1
1	0	1
1	1	1

3. NOR Gate



A	B	Y = A.B
0	0	1
0	1	0
1	0	0
1	1	0

4. AND Gate



A	B	Y = A.B
0	0	0
0	1	0
1	0	1
1	1	1

5. NAND Gate

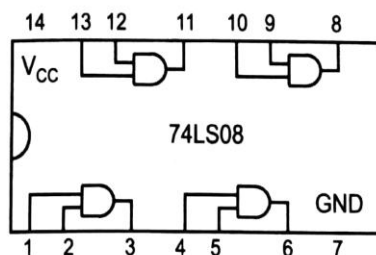


A	B	Y = A.B
0	0	0
0	1	0
1	0	1
1	1	1

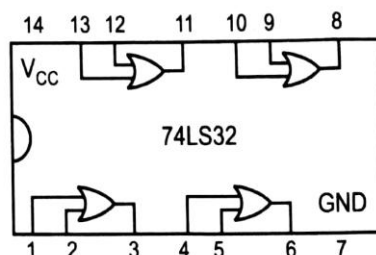
Procedure:

1. Notice the pin configuration of IC's given to you.
2. Connect pin 7 and pin 14 to GND and +VCC respectively.
3. Connect the input terminals as per pin configuration shown in fig.a. and verify the output using LED.
4. Verify the truth table for each logic gates.

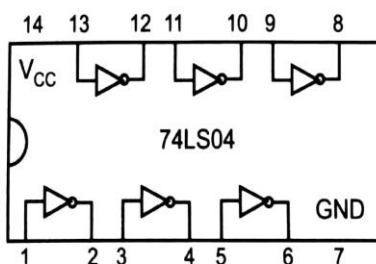
IC 74LS08 (AND)



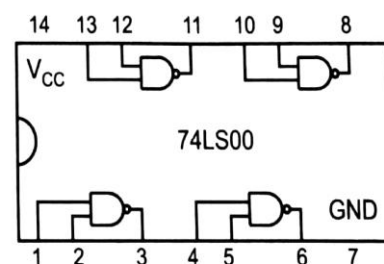
IC 74LS32 (OR)



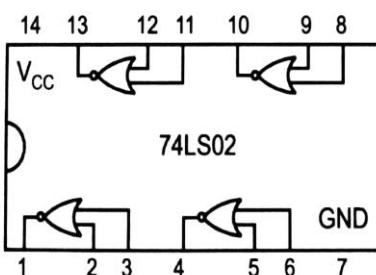
IC 74LS04 (NOT)



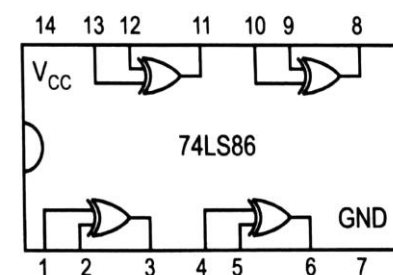
IC 74LS00 (NAND)



IC 74LS02 (NOR)



IC 74LS86 (EX-OR)



Result: All logic gates are verified.

Oral Questions

1. What are basic logic gates?
2. What is truth table? What is Boolean equation?
3. Which gates are called universal gates? Why?
4. What is difference between digital signals and analog signals?
5. State any two applications of logic gate ICs.

Experiment No. 2

NAND AND NOR GATES AS UNIVERSAL GATE

Aim:

To study NAND and NOR gates as a Universal gate.

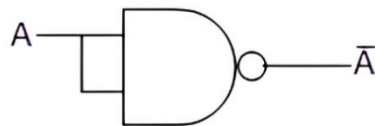
Apparatus:

IC 7400, IC 7402, power supply, connecting wires.

Diagram:

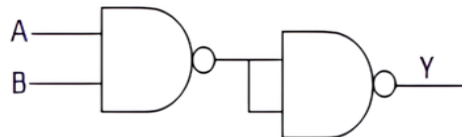
A. NAND gate as a Universal Gate:

1. NOT Gate



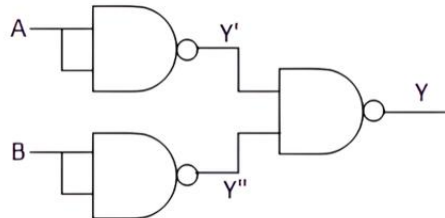
A	$Y = \bar{A}$
1	0
0	1

2. AND Gate



A	B	$Y = A.B$
0	0	0
0	1	0
1	0	0
1	1	1

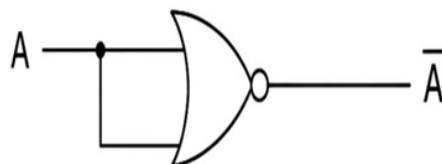
3. OR Gate



A	B	$Y = A+B$
0	0	0
0	1	1
1	0	1
1	1	1

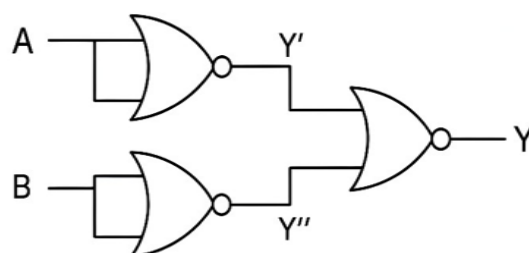
B. NOR gate as a universal gate:

1. NOT Gate



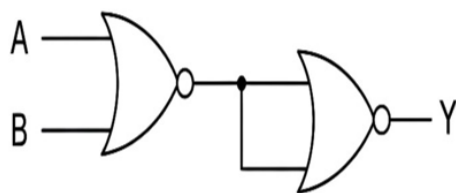
A	$Y = \bar{A}$
1	0
0	1

2. AND Gate



A	B	$Y = A.B$
0	0	0
0	1	0
1	0	0
1	1	1

3. OR Gate



A	B	$Y = A+B$
0	0	0
0	1	0
1	0	0
1	1	1

Procedure:

1. Notice the pin connections of IC's given to you.
2. Apply +5V to pin number 14 and GND to pin number 7.
3. Make the connections as shown in the figure.
4. Build the basic logic gates from NAND gate as shown in the figure and verify the output.
5. Repeat the step 2 to step 4 for NOR gate.

Oral Questions

1. What is a NAND gate? Why is it called a universal gate?
2. What is a NOR gate? Why is it called a universal gate?
3. How can a NOT gate be constructed using only NAND gates?
4. How can AND and OR gates be realized using only NOR gates?
5. Write the truth tables of NAND and NOR gates and explain their outputs for all possible input combinations.

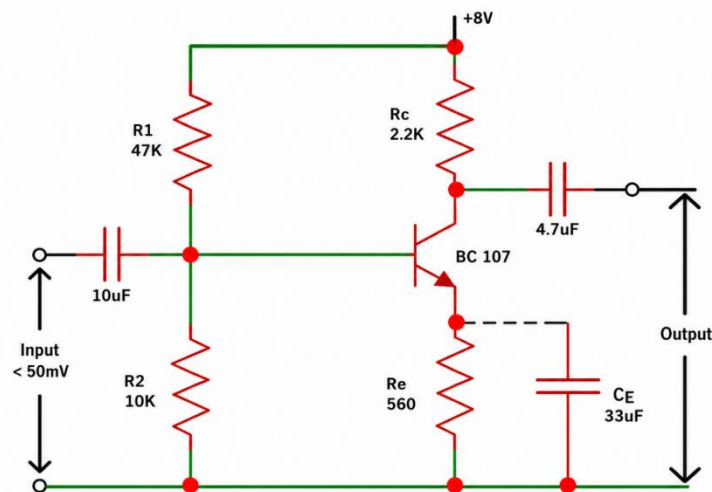
Experiment No. 3 NEGATIVE FEEDBACK AMPLIFIER

Aim:

To construct a negative feedback amplifier and measure the voltage gain of the amplifier with and without negative feedback.

Apparatus:

Transistor (BC-107/BC-547), CRO/DSO, Function Generator, resistor, capacitor.

Diagram:**Procedure:**

1. Connect the circuit as shown in the figure.
2. Set a suitable sinusoidal input signal, for example, at a frequency of 1 kHz.
3. Set the input voltage V_i to a suitable small value so that the amplifier operates in its linear region.
4. Connect the CRO/DSO across the output of the amplifier and measure the output voltage V_o .
5. Calculate the voltage gain without feedback using:

$$A_v = \frac{V_o}{V_i}$$

6. Now connect the negative feedback network between the output and input of the amplifier according to the circuit diagram.
7. Maintain the same input voltage and frequency as used for the measurement without Feedback.
8. Observe and measure the output voltage V_{of} using the CRO/DSO.
9. Calculate the voltage gain with negative feedback using:

$$A_{vf} = \frac{V_{of}}{V_i}$$

10. Repeat the measurements for different input voltages while keeping the frequency constant.

Observation Table:

- a. Input Voltage = V_i = _____ mV
b. Frequency of input signal = _____ KHz

Obs. No.	Input Voltage V_i (mV)	Output Voltage without feedback V_0 (V)	Gain without feedback (A_v)	Output Voltage with feedback V_{of} (V)	Gain with feedback (A_{vf})
1					
2					
3					
4					
5					
6					
7					
8					

Calculations:

Result:

1. Gain of the Amplifier (Without feedback) = _____
2. Gain of the Amplifier (With feedback) = _____

Oral Questions

1. What is meant by negative feedback in an amplifier? Explain its working principle.
2. Derive the expression for the voltage gain of an amplifier with negative feedback.
3. What are the advantages of using negative feedback in an amplifier?
4. How does negative feedback affect the gain, bandwidth, distortion, and stability of an amplifier?
5. An amplifier has an open-loop voltage gain of 100 and a feedback factor of 0.05. Calculate the voltage gain with negative feedback.

Experiment No. 4

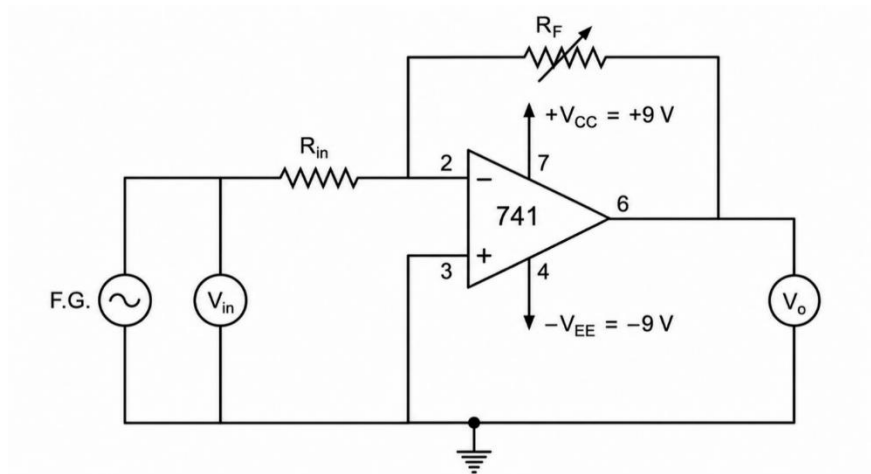
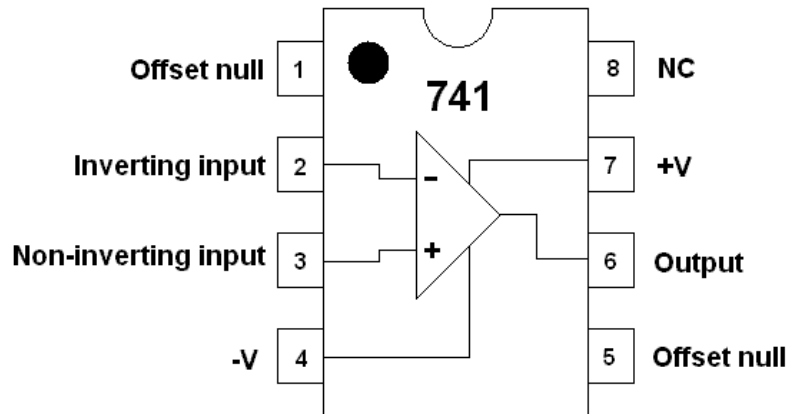
TO STUDY OP-AMP AS AN INVERTING AMPLIFIER

Aim:

To build the circuit of an op-amp as an inverting amplifier and study its gain and frequency response.

Apparatus:

Op-Amp, power supply, frequency generator, CRO/DSO, etc.



Procedure:

1. Connect the circuit as shown in the fig.
2. For studying voltage gain: Keep the input voltage V_{in} and input frequency f constant. Also keep R_{in} constant. Vary the feedback resistance R_F . Note the corresponding output voltage for each value of R_F .
3. For studying frequency response: Keep input voltage V_{in} and input resistance R_{in} and feedback resistance R_F constant. Vary the input frequency. Note the corresponding output voltage for corresponding input frequency.
4. Calculate the gain. Plot the graph of gain (A) and $\log f$.
5. From graph find the upper cut frequency and bandwidth.

Observation Table I:

For calculating Gain:

- a. Input voltage = V_{in} = _____ Volt
b. Input frequency = f = _____ KHz

Obs. No.	Resistance R_{in} ohm	Resistance R_f ohm	Output Voltage V_o	Observed Gain $A = \frac{V_o}{V_{in}}$	Calculated Gain $A = \frac{R_f}{R_{in}}$
1					
2					
3					
4					
5					
6					
7					
8					
9					

Observation Table II:

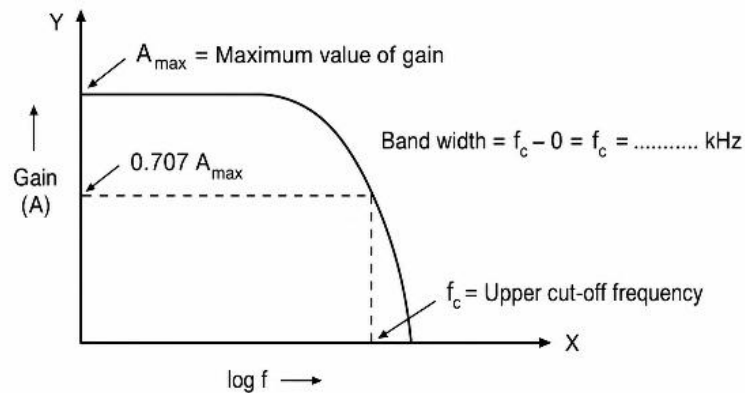
To study frequency response:

- a. Input voltage = V_{in} = _____ Volt
b. Input Resistance = R_{in} = _____ ohm
c. Feedback Resistance = R_f = _____ ohm

Obs. No.	Frequency f KHz	Output Voltage V_o volt	Observed Gain $A = \frac{V_o}{V_{in}}$	$\log f$
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				

Calculations:

Nature of Graph:



Result:

1. Observed and calculated gain are almost same.
2. Bandwidth of Op-Amp inverting amplifier = B.W. = $\dots\dots\dots \text{Hz}$.

Oral Questions

1. Define Op-Amp.
2. State ideal characteristics of op-amp.
3. Do op-amp inverting amplifier amplify DC?
4. What is frequency response and bandwidth?

Experiment No. 5 TO STUDY OP-AMP AS A SCHMITT TRIGGER

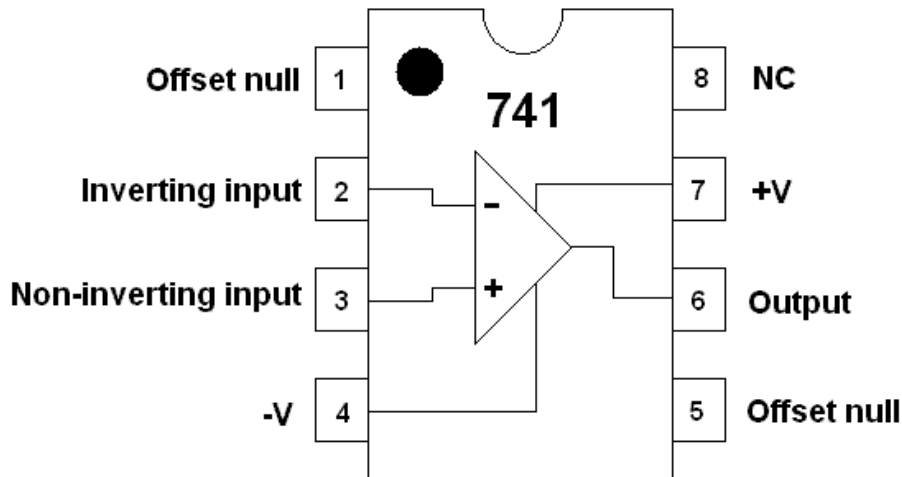
Aim:

To build and study the circuit of an op-amp as a Schmitt trigger.

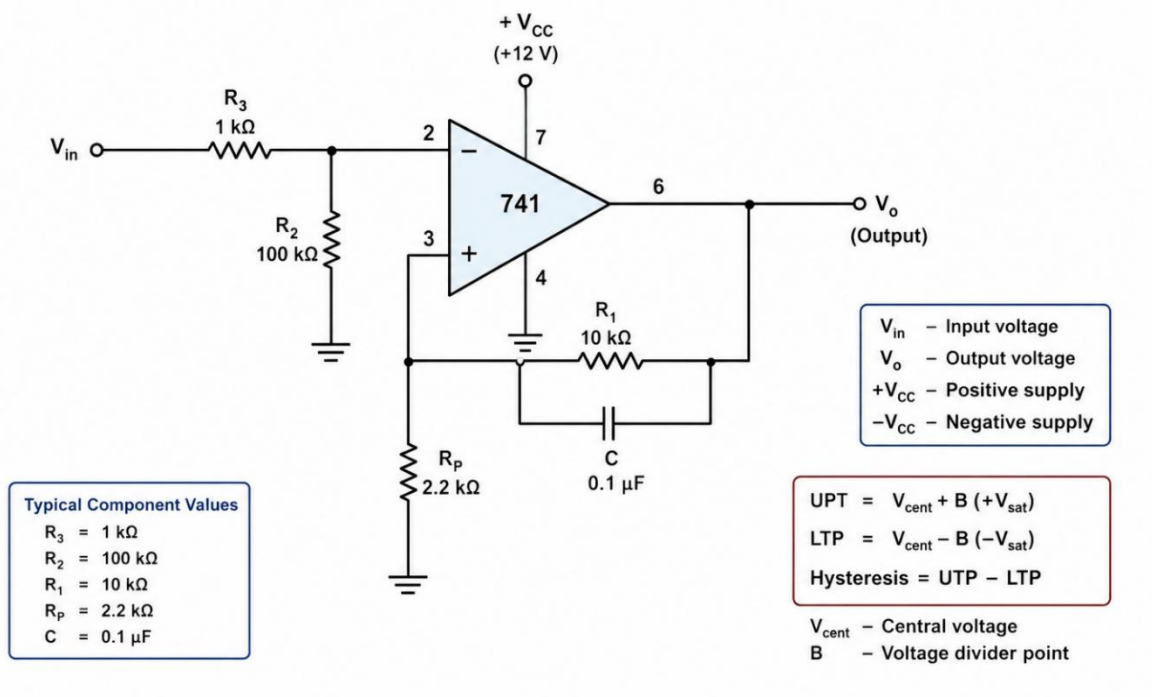
Apparatus:

IC-741, resistors, capacitor, power supply, voltmeter, etc.

Diagram:



OP-AMP AS SCHMITT TRIGGER



Formula:

1. $UTP = V_{cent} + B(+V_{sat})$

2. $LTP = V_{cent} - B(-V_{sat})$

3. $V_{cent} = [R_2 / (R_2 + R_3)] \times VCC$

4. $1/R_p = 1/R_2 + 1/R_3$

5. $B = R_p / (R_1 + R_p)$

6. $Hysteresis = UTP - LTP$

Where: UTP – Upper trip point

LTP – Lower trip point

V_{cent} – Central voltage

B – Voltage divider point

$+V_{sat}$ – Positive saturation voltage

$-V_{sat}$ – Negative saturation voltage

Procedure:

1. Connect the circuit as shown in the circuit diagram in Fig. b
2. By increasing the input voltage (V_{in}), note down the output voltage (V_o) for each value of input voltage (V_{in}). Continue the process till the output voltage suddenly changes from constant minimum value to constant higher maximum value (saturation voltage value V_{sat}). Report these readings in the observation table. The input voltage (V_{in}) at which the output changes from low to high is called upper trip point (UTP) voltage.
3. After step (2) above, slightly increase the input voltage V_{in} and then decrease in steps and note the corresponding output voltage. Write these values of V_{in} and V_o in the observation table. The V_{in} at which V_o suddenly drops to low is called lower trip point (LTP) voltage.
4. Plot a graph between V_o and V_{in} . From the graph, find the values of UTP and LTP.
5. Also find values of UTP and LTP from formula.
6. Find the value of hysteresis. Obtain results.

Observation Table:

Obs. No.	Increasing input voltage V_{in} (volt)	Output voltage V_o (volt)	Decreasing input voltage V_{in} (volt)	Output voltage V_o (volt)
1				
2				
3				
4				
5				

Calculations:

1. $V_{cent} = [R_2 / (R_2 + R_3)] \times VCC =$ _____

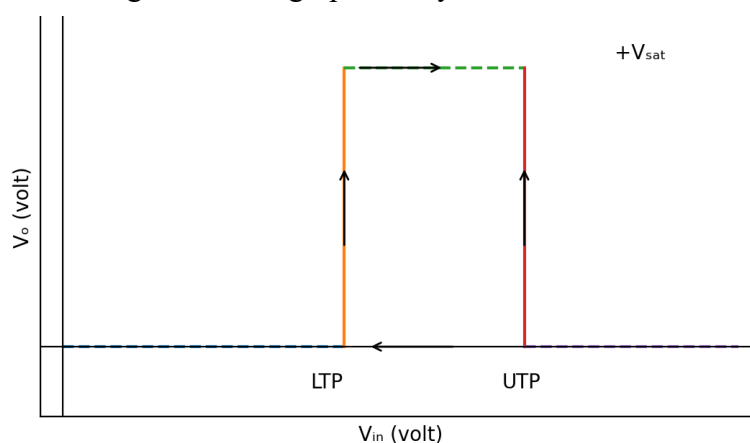
2. $1/R_p = (1/R_2) + (1/R_3) =$ _____

3. $UTP = V_{cent} + B(+V_{sat}) =$ _____

4. $LTP = V_{cent} - B(-V_{sat}) =$ _____

Nature of Graph:

From the observation table, plot a graph between output voltage (V_o) and input voltage (V_{in}). Its nature is as shown in Fig. 10.2. The graph is a hysteresis curve for the Schmitt trigger.



Hysteresis curve for Schmitt trigger

Results:

1. UTP voltage (a) from graph = _____ volt, (b) from formula = _____ volt
2. LTP voltage (a) from graph = _____ volt, (b) from formula = _____ volt
3. Hysteresis of Schmitt trigger from the graph = _____ volt
4. Hysteresis of Schmitt trigger from the formula = _____ volt

Oral Questions

1. What is Schmitt trigger?
2. Explain the circuit operation of Schmitt trigger.
3. What is op-amp? Give characteristics of practical op-amp.
4. What is hysteresis?

Experiment No. 6 ASTABLE MULTIVIBRATOR

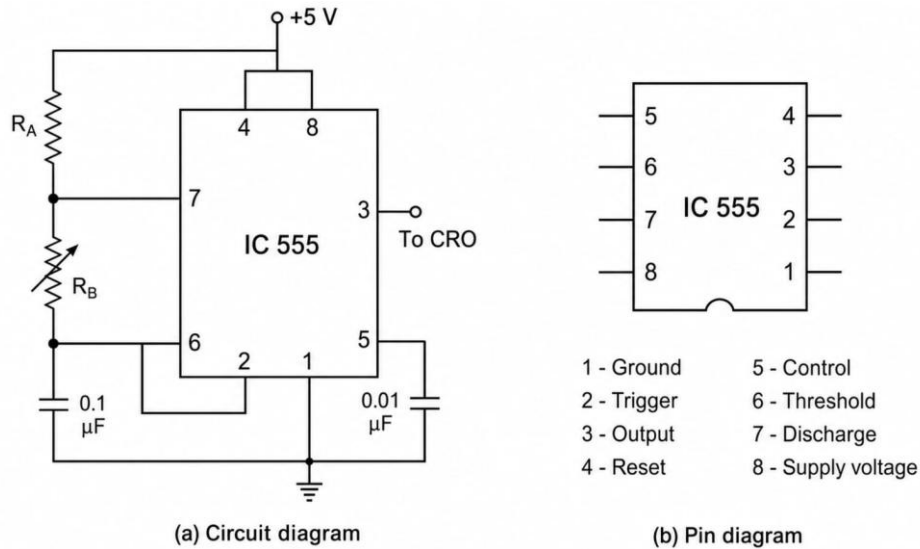
Aim:

To design and test an astable multivibrator using IC-555 timer.

Apparatus:

IC- 555, CRO, resistances, capacitors, power supply etc.

Diagram:



Formula:

1. $T_{\text{CHARGING}} = T_{\text{ON}} = 0.693(R_A + R_B) * C$
2. $T_{\text{DISCHARGING}} = T_{\text{OFF}} = 0.693(R_B) * C$
3. $T = T_{\text{ON}} + T_{\text{OFF}} = 0.693(R_A + 2R_B) * C$
4. $\text{Duty Cycle} = D = \frac{(R_A + R_B)}{R_A + 2R_B}$
5. $\text{Frequency} = F = \frac{1}{T}$

Where,

$T_{\text{CHARGING}} = T_{\text{ON}}$ = Charging time of capacitor

$T_{\text{DISCHARGING}} = T_{\text{OFF}}$ = Discharging time of capacitor

T = Total time period

D = Duty cycle

F = Frequency of output waveform

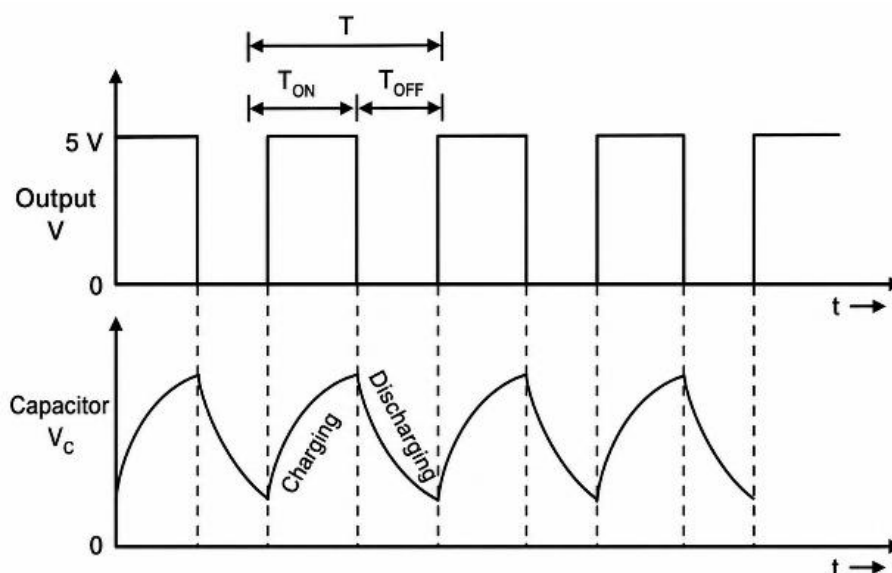
Observations:

1. Capacitance = $C = 0.1 \mu\text{F} = 0.1 * 10^{-6} \text{F}$
2. Resistance = $R = 47 \text{ K}\Omega = 47 * 10^3 \text{ohm}$

Observation Table:

Obs. No.	Resistance R_B K ohm	Time periods			Observed frequency F Hz	Calculated frequency F Hz	% Duty cycle
		Charging time T_{ON} sec	Discharging time T_{OFF} sec	Total T sec			
1							
2							
3							

Nature of Graph:



Procedure:

1. **Design:** Select values of components: capacitor C , resistance R_A and R_B for the desired value of F and D .
2. Connect the circuit as shown in the circuit diagram with selected values of C , R_A and R_B . Apply supply voltage (+5 V) and as shown in the circuit diagram. For these values of C , R_A and R_B , observe values of T_{ON} , T_{OFF} , T and F on the screen waveform on CRO/DSO screen. Also calculate frequency F from formulae. Report these values in the observation table.
3. Repeat the step 1 for different values of R_B . and observe the output on CRO/DSO.
4. Trace the output waveform on trace paper.
5. Verify the designed output and waveform output.

Result:

1. The output waveform of astable multivibrator is square wave.
2. The variation of observed frequency, calculated frequency and duty cycle is as shown in the observation table.
3. Tracing of waveforms at capacitor and at output is as shown in graphs.

Oral Questions

1. What is an astable multivibrator, and why is it called a free-running oscillator?
2. What is the function of the timing resistors and capacitor in an IC 555 astable multivibrator?
3. Derive the expression for the frequency of oscillation of an IC 555 astable multivibrator.
4. How can the duty cycle of an astable multivibrator be calculated? What factors affect it?
5. What happens to the output frequency if the value of the timing capacitor is increased? Explain.

Experiment No. 7

MONOSTABLE MULTIVIBRATOR

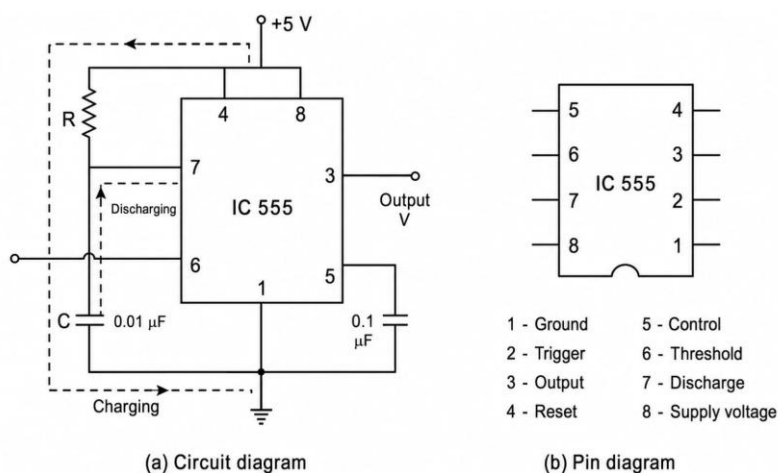
Aim:

To design and test monoastable multivibrator using IC-555 timer.

Apparatus:

IC- 555, CRO, resistances, capacitors, power supply etc.

Diagram:



Formula:

$$1. T_{ON} = 1.1 * R * C$$

Where, T_{ON} is the pulse width output waveform

R is resistance

C is capacitor

Observation:

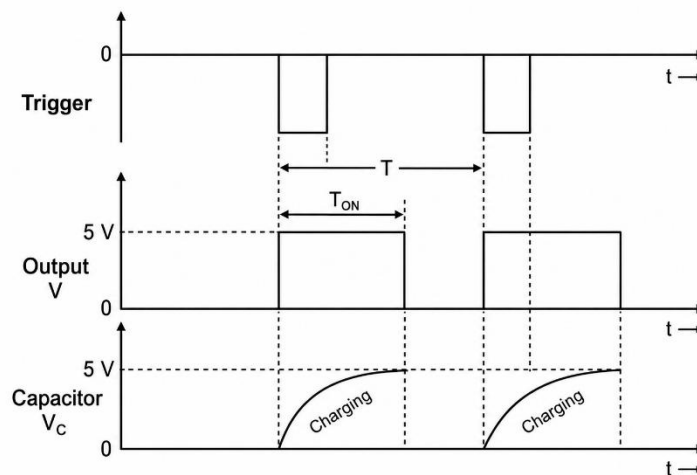
Capacitance, C = _____ farad

Observation Table:

Obs. No.	Resistance	Output pulse width	
		Observed T_{ON} (sec)	Calculated T_{ON} (sec)
1			
2			
3			

Calculations:

Nature if waveform:



Procedure:

Design:

1. Select the value of R and C for desired pulse width of the IC-555 in monostable multivibrator mode.
2. Design the T_{ON} such that time triggered pulse is sufficiently smaller than time period.

Testing:

1. Connect the circuit as shown in the figure.
2. Connect the output terminal to the CRO/DSO. Trace the output using trace paper.
3. Find the value of T_{ON} from the waveform. And compare the calculated and observed value.
4. Repeat the procedure for different value of R by keeping the the capacitance value constant.

Result:

1. Pulse width of the waveform is varying with value of resistance.
2. Observed and calculated value are almost same.

Oral Questions:

1. What is a monostable multivibrator?
2. How many stable states does a monostable multivibrator have?
3. Which IC is commonly used to construct a monostable multivibrator?
4. What is the function of the trigger pin in IC 555?
5. What is the use of the capacitor in a monostable multivibrator?

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