Experiment No 01

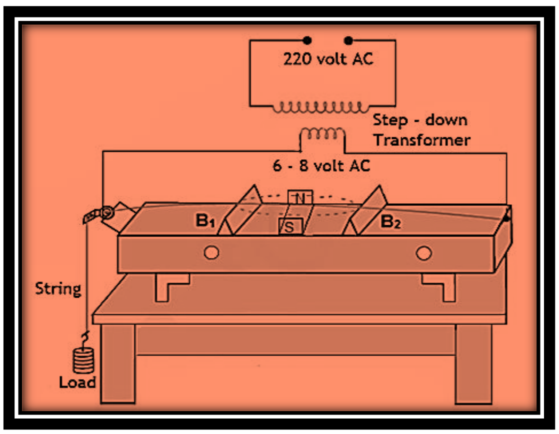
Aim: To determine the frequency of AC mains using a sonometer.

Apparatus: Sonometer with brass wire, a horse shoe magnet, a step down transformer, hanger with weight and a screw gauge, connecting wire etc.

Formula:

$f = \frac{1}{2l}\sqrt{\frac{T}{m}}$ where f is the frequency of the mains A.C l is the length of the wire vibrating in resonance with A.C oscillations, m is the mass of wire per unit length, T (tension in the wire)=Mg , here M is the mass hung on the hanger.

Figure:



Theory:

A sonometer is an apparatus used to study the transverse vibrations of stretched strings. It is in the form of a hollow wooden rectangular box. On the wooden rectangular box there are two bridges and a pulley at one end. A wire string is attached to one end of the wooden box, run over the bridges and pulley and carries a weight hanger at the free end as shown in figure below.

A sonometer is used to determine the frequency of alternating current. A step down transformer is used for the determination of frequency of A.C. because the voltage of the A.C. mains is 220V, which is dangerous. The step down transformer reduces this voltage to 6 volts.

The string wire of the sonometer is a non-magnetic metallic wire like brass or copper. A horse shoe magnet is placed at the middle of the sonometer wire so that the magnetic field is applied perpendicular to the sonometer wire in a horizontal plane. When an alternating current of definite frequency passes through the wire there will be interaction between the magnetic field and the current carrying conductor. So a force will act on the conductor in a direction perpendicular to both the field and the direction of current. When A.C. is passing through the conductor, since the current direction reverses periodically, the direction of force also reverse periodically and hence, the conductor vibrates. Since the current flowing is alternating, the wire vibrates with a frequency equal to the frequency of A. C. By adjusting the length of the vibrating wire segment, this frequency can be made equal to the natural frequency of the wire segment. Then the resonance takes place and the wire vibrates with maximum amplitude. At this stage, the length of the wire segment is called the resonating length and it increases with increase in the mass of the suspended weights. When the length 'l' of the sonometer wire vibrates with maximum amplitude, the frequency of the applied A.C. is equal to the natural frequency of the wire. $\boldsymbol{f = \frac{1}{2l}\sqrt{\frac{T}{m}}}$

Procedure:

1. Place the sonometer on the table.
2. Attach a weight hanger at the free end of the string which passes over the pulley.
3. Stretch the wire by loading a suitable maximum mass on the weight hanger.
4. The sonometer wire is connected to the secondary of the step down transformer.
5. The horse shoe magnet is mounted at the middle of sonometer bed so as to produce a magnetic field perpendicular to the wire.
6. The opposite poles of the magnet must face each other.
7. The bridges are placed on either side of the magnet at equal distance from the magnet and are close to each other.
8. A light paper rider is placed on the wire between the bridges of the sonometer.
9. The A.C. supply is switched on.

10. The wire begins to vibrate.
11. The length of the wire between the two bridges is adjusted till the wire vibrates with maximum amplitude. At this stage, the paper rider placed on the wire is thrown off, which shows the condition of resonance.
12. -The length of the wire between the two bridges is measured. This is called the resonating length l.
13. Repeat the experiment for different loads.
14. The linear density of the wire, m, can be calculated using the relation, $m = \pi r^2 \rho$, where r is the radius of the wire which can be measured using the screw gauge.
15. By knowing the linear density, m, of the wire, the frequency of A.C. mains supply is calculated using the formula

Observations:

Least count of screw gauge (Pitch/Total no. of div.) =…..……….. metre
Radius of wire(r) = ………. ………….metre.
Density of the material of the wire (ρ) =………kg/m^3

S.No.	Mass hang on the wire (M) Kg	Tension T=Mg (Newton)	Position of first knife edge X_1(m)	Position of Second knife edge X_2(m)	Length of vibrating wire : L= X_2 - X_1 (m)
1					
2					
3					

Calculations:

Mass per unit length (m) = $\pi r^2 \rho =$ ………..kg/m.

Frequency of A.C. mains = $f = \frac{1}{2l}\sqrt{\frac{T}{m}}$

Mean frequency of A.C. (f) =…………………Hz.

Result:

Observed (Mean) value of frequency of A.C. (f) =…………………Hz.
Standard value of frequency of A.C. Mains = 50Hz.

Percentage Error:

$$\frac{\text{Standard Value – Observed Value}}{\text{Standard value}} x\ 100 = \text{………..\%}$$

Precaution & Source of Error:

1. There should be no kinks in the sonometer wire.
2. Pulley should be frictionless.
3. Horse shoe magnet should be placed in the middle.
4. Mass of the hanger should be included in T.
5. The distance between the two knives edges should be altered very slowly otherwise resonance point would be missed.
6. The diameter should be determined at various points.

Experiment No: 02

Aim: To determination of wavelength of sodium light by Newton Rings.

Apparatus Required: A sodium lamp, Newton ring apparatus (consisting of a traveling microscope, a plano convex lens placed on a plane glass plate and a glass plate inclined at an angle of 45°, spherometer, magnifying glass etc.

Formula Used: $\lambda = \frac{D_{n+p}^2 - D_n^2}{4pR}$

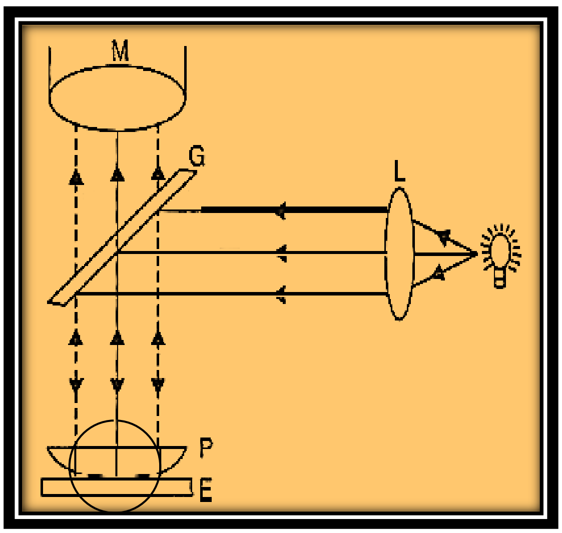
$Where\ D_{n+p}\ is\ diameter\ of\,(n+p)^{th}\ ring\ and\ D_n is\ diameter\ of\ n^{th}\ ring$

R is the radius of curvature of the plano convex lens.

Theory of experiment

Introduction: Circular interference fringes can be observed if a very thin film of air or some other transparent medium of varying thickness is enclosed between a plane glass plate and plano-convex lens of large focal length. Such fringes were first observed by Newton and so are called Newton's Rings.

Experimental Arrangement:



Light from monochromatic source B is rendered parallel by a convex lens L and then it is made to fall on a glass plate G inclined at an angle of 45° to the incident beam. This beam is reflected normally on to a plano-convex lens P placed on a glass plate E as shown in figure. Light rays reflected from the top and bottom surfaces of the air film formed between the lens P and glass plate E superimpose upon each other and depending upon the path difference between these rays, circular bright and dark rings are observed with a monochromatic light. The fringes are circular because the air film is symmetrical about the point of contact of the lens O and the plane glass plate E. These fringes can be observed by a traveling microscope M which can also measure the diameter of the various rings.

Procedure:

1. Level the microscope and find the vernier constant of the horizontal scale of microscope.
2. Put the Newton ring apparatus in position place the arrangement in front of a sodium lamp so that the height of the centre of the glass plate G is the same as that of the centre of the sodium lamp.
3. Focus the microscope so that it lies vertically above the centre of the lens and alternate dark and bright rings are clearly visible.
4. Adjust the position of the microscope so that the point of intersection of the cross – wire coincides with the centre of the ring system and one of the cross-wires is perpendicular to the horizontal scale.
5. Move the microscope to the left so that the cross-wires lie tangentially along the 20^{th} dark ring. Note the reading on the vernier scale of the microscope. Move the microscope backward with the help of the slow motion screw and note the reading when the cross-wires lies tangentially at the center of the 16^{th}, 12^{th}, 8^{th}, 4^{th} dark rings respectively. Keeping on sliding the microscope to the right and note the reading when the cross-wire again lies tangentially at the 4^{th}, 8^{th}, 12^{th}, 16^{th}, 20^{th} dark rings.
6. After reaching the 20^{th} ring move the microscope backwards and again not the readings corresponding to the same rings on the right and then on the left of the centre of the ring system.
7. Remove the lens P and find the radius of curvature of the surface of the lens in contact with the glass plate E with the help of a spherometer

Observation:
Pith of the micrometer = ………………….cm
No. of divisions on circular scale = ………
Least count = Pitch/ n=….……………………..cm

S.No	No. of Fringes	Micro meter reading						Diameter D=(a-b)	D^2
		Left side			Right side				
		MSR	VSR	a=MSR+VSR x LC	MSR	VSR	b=MSR+VSR x LC		
1	4								
2	8								
3	12								
4	16								

Observation for Radius of Curvature
$R = \frac{l^2}{6h} + \frac{h}{2}$ *where* l = Distance between the two legs of spherometer
Pith of the spherometer = ………………….cm
No. of divisions on circular scale = ………
Least count = *Pitch/ n*
Distance between the two legs of spherometer (l) = …. Cm

S.No	Spherometer Reading						h=(X-Y) cm	Mean h Cm
	Plane surface of glass plate			On plano convex lens				
	MSR	VSR	X=MSR+VSR x LC	MSR	VSR	Y=MSR+VSR x LC		
1								
2								

Calculation:
$$Wavelength\ of\ sodium\ light\ (\lambda) = \frac{D_{n+p}^2 - D_n^2}{4pR}$$

Result: Observed (Mean) wavelength of sodium light =………………… Å
Standard wavelength of sodium light = 5896Å

Percentage Error:
$$\frac{\text{Standard Value – Observed Value}}{\text{Standard value}}\ x\ 100 = \text{………..\%}$$

Precautions:
1. The lens and the glass plate should be cleaned properly.
2. Lens of a large focal length should be used.
3. The point of intersection of the cross-wires should coincide tangentially with a particular ring.
4. The micrometer screw should always be moved in the same direction to avoid back lash error.
5. The radius of curvature of the surface of the lens is contact with the glass plate should be measure accurately in formula since
6. The amount of light for the source should be adjusted for maxima visibility of the rings and good contrast between dark and bright ring.

Experiment No: 03

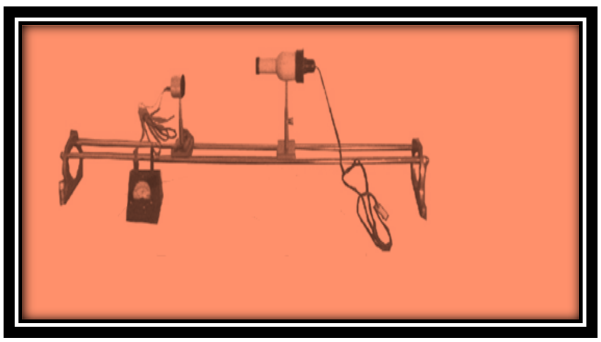
Aim: To study photo-conducting cell and verify the inverse square law using photovoltaic cell.

Apparatus: Photovoltaic cell, source of light, optical bench, micro-ammeter, uprights, connecting wire.

Formula: Intensity of illumination is inversely proportional to the square of distance between source and Photo cell upright. Since intensity of illumination is directly proportional to electric current produced or deflection.

$Current\ \alpha \frac{1}{d^2}$

Diagram



Procedure: The optical bench contains two uprights and carries the electric bulb and other carries a photovoltaic cell. The two terminal of photovoltaic cell is connected to ammeter.

1. Make the electrical arrangement (connection) and adjust lamp and scale arrangement.
2. Fix the photovoltaic cell in one position.
3. Now move the bulb towards photovoltaic cell slowlv

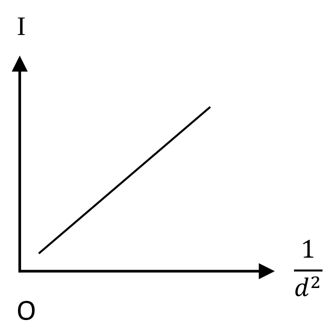
Observation:

S. No.	Distance between lamp and photocell(d) cm	I (µm)	d^2	$\frac{1}{d^2}$
1				
2				
3				
4				
5				
6				
7				

Calculations:

Plot a graph between I and $\frac{1}{d^2}$.

Relation between current and $\frac{1}{d^2}$ is a straight line.



Result: A graph between I and $\frac{1}{d^2}$ is comes out to be straight line this verify inverse square law.

Sources of Error and Precautions:

1. The photocell should not be exposed to light get long time continuously.
2. Bulb should be mounted in such a way that light falls normally on the surface of photocell.

Experiment No: 04

Aim: To find the specific rotation of cane sugar solution using polarimeter.

Apparatus : Polarimeter, graduated cylinder, common balance, weight box, beaker, a wall glass, magnifying glass, sodium or mercury lamp, electric lamp, magnifying lens, filter pap tunnel, glass rod, sugar.

Theory:

Specific Rotation: Specific rotation for a given temperature t °C and for a light of given wavelength λ is defined as the rotation (in degrees) produced by a path of one decimeter length in a substance of unit density.

It θis the rotation produced by decimeter length of a solution of density (d); then specific rotation S corresponding to some temperature t and light of wavelength λ is given by:

$$S = \frac{\theta}{lxC} = \frac{\text{Rotation in degrees}}{\text{Length in decimeter Xconcentration in g/cc}}$$

Sugar is the most commonly used optically active substance and the instruments used for measuring the optical rotation produced by substance are called polarimeters. Basically, they consist of two Nicol Prism capable of measuring angle of rotation of plane polarized light produced by optically active substance. The optically active substance is placed between the two nicol prisms. Generally, it is very difficult to locate the position of analyzing nicol when no light is received but with the used of Laurent's half shade device, this difficulty is overcome.

LAURENT'S HALF SHADE POLARIMETER:

It is an instrument used for finding angle of rotation of an optically active substance like sugar solution, it is called a saccharimeter

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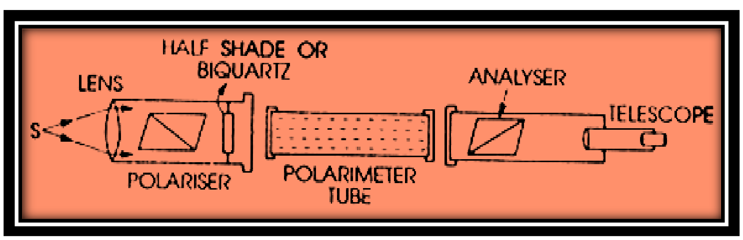


Construction: It consists of two Nicol Prisms mounted in brass tube and capable of rotation about a common axis. Glass tube containing optically active solution is placed in between the two Nicol Prisms as shown in fig. All the tubes are in line. Monochromatic light from a source is rendered parallel by a convex lens and is made to fall on polarizing prisms which renders the light plane polarized with its vibrations in the principal plane of the nicol prism. This polarized light is then made to pass through half shade device and the tube containing the active solution and then in passes through analyzing Nicol prism. **The emergent light is viewed through telescope T.**

Procedure:

1. If the polarimeter is employing a half shade device, a monochromatic source should be used and if bi quartz device is used then white light can be used.
2. Take the polarimeter tube and clean well both the sides such that it is free from dust. Now fill the tube with pure water and see that no air bubble is enclosed it. Place the tube in its position inside the Polarimeter.
3. Switch on the source of light and look through the eyepiece. Two halves of unequal intensity is observed. Rotate the analyser until two halves of the field appears equal bright. Take the reading of main scale as well as vernier scale and find out the total reading.
4. Prepare the sugar solution of unknown strength. The procedure for preparing it can be seen under the heading observations.
5. Take the polarimeter tube and remove the pure water and fill it with the prepared sugar solution and again place it in the polarimeter.
6. Rotate the analyser to obtain the equal intensity position, first in clockwise direction and then in anti-clockwise direction.

7. [When the tube containing sugar solution is placed in the path of the polarized light, the plane of polarization is rotated which disturbs the previous position.]
8. Note down the position of the analyser on main and vernier scales in the two directions. Find the mean reading. The difference between this and previous reading gives the specific rotation.
9. Repeat the experiment with the sugar solutions of different concentrations.
10. Measure the length of the tube in centimetres and change it in decimetres.

Observation: -

Least count of polarimeter = ……….. deg
Length of polarimeter tube = …………..dm

S.No	Analyser reading with pure water						
	Clockwise			Anticlockwise			A= (X+Y)/2 Deg
	M.S.R.	V.S.R.	Total X= MSR+(VSR X LC) deg	M.S.R.	V.S.R.	Total X= MSR+(VSR X LC) deg	

S.No	Analyser reading with pure Solution						
	Clockwise			Anticlockwise			A= (X+Y)/2 Deg
	M.S.R.	V.S.R.	Total X= MSR+(VSR X LC) deg	M.S.R.	V.S.R.	Total X= MSR+(VSR X LC) deg	

Calculation:

$$S = \frac{\theta}{lxC} = \ldots\ldots\ldots\ldots\ldots\ldots \frac{\text{deg}}{deci\ meter\ x\ gram\ per\ cc}$$

Result: - The specific rotation for cane sugar at a room temperature using monochromatic light is ----------

Percentage Error:

$$\frac{\text{Standard Value – Observed Value}}{\text{Standard value}}\, x\ 100 = \ldots\ldots\ldots\%$$

Precaution:-

1. The polarimeter tube should be well cleaned.
2. Whenever solution is changed, rinse the tube with the new solution under examination.
3. The position of analyzer should be set accurately.
4. The temperature and wavelength of light used should be stated.
5. Reading should be taken when halves of the field of view becomes equally illuminate.

Experiment No. 05

Aim: To Determination of the Resolving Power of a Telescope.

Apparatus: Reading Telescope, Attachment of resolving power of the telescope, Number of patterns on glass with stand, Incandescent bulb 40watt with house on stand, Inch tape.

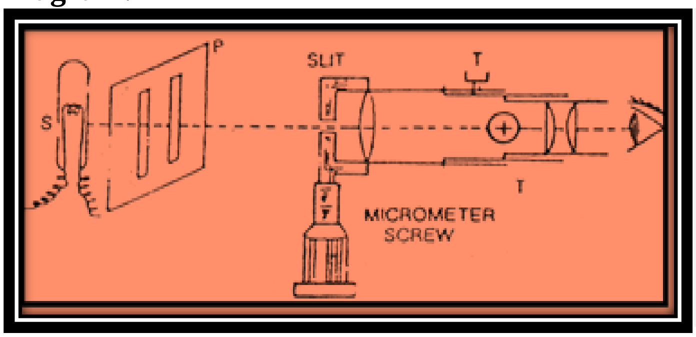
Theory and Formula Used:

Theoretical resolving power = λ/a Where λ = mean wavelength of light employed, a = width of the rectangular slit for just resolution of two objects,

Practical resolving power = d/D Where d = separation between two object and D = distance of the objects from the objective of the telescope. Hence $\frac{\lambda}{a} = \frac{d}{D}$

Rayleigh's criterion of resolution .According to Rayleigh's criterion, two equally bright sources can be just resolved by any optical system when their distance apart is such that in the diffraction pattern, the maximum due to one falls on the minimum due to the other.

Diagram:



Resolving power of Telescope.

The resolving power of telescope of a telescope may be defined as the inverse of the least angle subtended at the objective by two distant point object which can be just distinguished as separate in its focal plane.

Procedure:

1. Focus the telescope for clear image far from the telescope.
2. Keep the incandescent bulb (in lieu of sodium lamp we have used incandescent bulb to reduce the cost) in the front of slit pattern
3. Mount the telescope on a stand such that its axis lies horizontal and the rectangular lines in first row marked on pattern board on stand which are vertical. Place the two stands at a suitable distance (say about 2 meters) fig.
4. Illuminate the object with source of light. Now open the slit with the help of micrometer screw and move the telescope in the horizontal direction such that the images of two vertical sources are in the field of view of the eyepiece.
5. Gradually reduce the width of the slit till the two images just cease to appear as two. Note down the reading of the micrometer. Again close the slit completely and note down the micrometer reading. The difference of the two readings gives the width of the slit (a) just sufficient to resolve the two images.
6. Width (d) of white or black rectangular strips in the first row marked on pattern board is one mm.
7. Measure the distance between the object and the slit with the help of inch tape which gives D.
8. The experiment is repeated for different values of D.

Observations:

Mean value of mm. (d) =……………..cm.

L.C. of screw = ……………………..cm.

S.No.	d cm	Slit Reading						Width of the Slit a = (X – Y)	Distance D mms.
		When Slit is Closed			Slit when Images Cease				
		M.S.	V.S	Total X=M.S+(V.S X LC)	M.S.	V.S	Total X=M.S+(V.S X LC)		

Calculation:

D = distance of the objects from the objective of the telescope.

Theoretical resolving power = λ/a

And practical resolving power = d/D

Where λ = mm. a = width of the rectangular slit for just resolution of two objects, d = ………cm

Hence $\frac{\lambda}{a} = \frac{d}{D}$

Result:

The theoretical and practical resolving powers of the telescope are shown in the table.

Theoretical and Practical Resolving Powers:

Distance mm	D Mm	Theoretical (λ/a) Resolving Power	Practical (d/D) Resolving Power

Precautions and Sources of Error:

1. The axis of telescope should be horizontal.
2. The rectangular object drawn on the pattern board should be vertical.
3. Backlash error in the micro-meter screw should be avoided.
4. The plane of the slit should be parallel to the objects.
5. The minimum width of slit for resolution should be adjusted very carefully.
6. The distance D should be measured from the slit of the telescope to the pattern board.

Experiment No: 06

Aim: To compare the capacitances of two condensers by De-Sauty's bridge and hence to find the dielectric constant of medium.

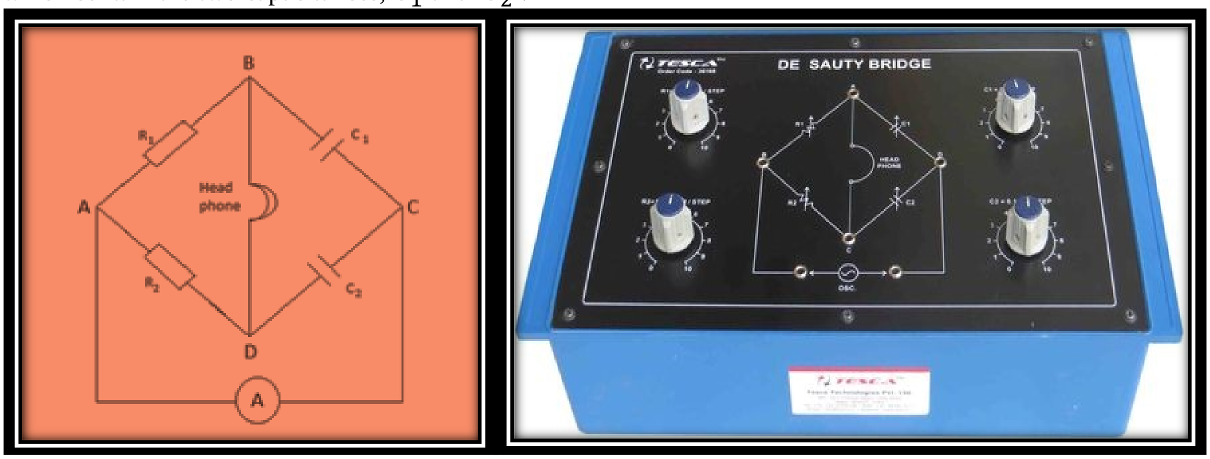
Apparatus Used:

Two condensers, high resistance boxes, accumulatorand connecting wires.

Formula Used:

The ratio of the capacitances of two condensers is given by: $\frac{C_1}{C_2} = \frac{R_2}{R_1}$

Where R_1 and R_2 are the resistances introduced in the two other arms of wheat stone's bridge, the two arms of which contain the two capacitances, C_1 and C_2 .



Procedure:

1. Make the electrical connections as in the fig. and switch on the oscillator.
2. Take out certain plugs from resistance box R_1 so that AB arm of the bridge offer some resistance.
3. Now start taking out plugs of resistance boxes R_2 such that sound in head phone in minimum.
4. Write down these values of R_1 and R_2 is the observation table.
5. Repeat the experiment to take at least six reading each time keeping some value of R_1 and then adjusting R_2 for minimum sound in head phone.
6.

Observation:

S.No.	R_1(ohms)	R_2(ohms) To balance the bridge	$\frac{R_2}{R_1}$	Mean of $\frac{R_2}{R_1}$
1				
2				
3				
4				
5				

Calculation:

The ratio of the capacitances of two condensers is given by: $\frac{C_1}{C_2} = \frac{R_2}{R_1}$

Result: The ratio of the capacitance of the given two condensers = ……

Sources of Error and Precautions:

1. The resistances R1 and R2 should be non-inductive.
2. For sufficient sensitiveness of the bridge, the battery should be of high E.M.F.
3. Sensitive head phone should be used
4. .

EXPERIMENT NO 07

Aim: To find the wavelength of sodium light by Michelson Interferometer.

Apparatus: Michelson Interferometer Setup, sprit level, telescope.

Formula Used: The wavelength of sodium light is given as $\lambda = \frac{(X_2 - X_1)}{N}$

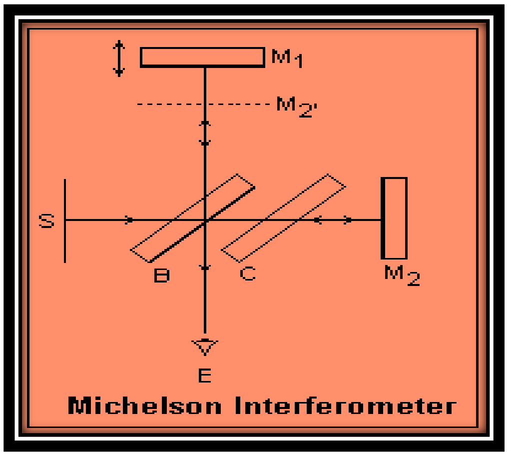
Where X_1= initial position of mirror M_1 of Michelson interferometer

X_2 = final position of mirror M_1 of Michelson interferometer

$(X_2 - X_1)$ =distance moved by mirror M1

N= number of fringes appeared at the center of field corresponding to distance $(X_2 - X_1)$

Diagram:



Procedure:

1. Adjust the position of mirror M_1, so that a bright spot of circular fringes appear the centre of field of view, Note corresponding micrometer reading.
2. The mirror M1is moved away so that a good number of fringes (say 25) appear at the center of the field .the micrometre reading is again noted.
3. The procedure is repeated to take various readings.

Observations: Least count of fine micrometer screw=--------------cm

S.No.	No of fringes appeared	Main scale reading(cm)	Position of mirror M1			Difference x for 50 fringes (cm)	Mean difference x(cm)
			RMS reading(cm)	FMS reading(cm)	Total (cm)		

Calculation: The wavelength of sodium light is given as $\lambda = \frac{(X2 - X1)}{N}$

Result: Wavelength of sodium light = -----------cm

Precautions:

1. Glass plate G1, G2 and mirrors M1, M2 should not be touched or cleaned.
2. The micro-metre screw should be handled carefully.
3. The screw behind mirror M2 should be rotated through a very small angle.
4. In the position of maximum indistinctness, the fringes should almost disappear.
5. There should be no disturbance near the experiment.

Experiment No: 08

Aim: To find the flashing quenching potential of Neon/Argon and also to find the capacitance of unknown Capacitor.

Apparatus Required:

Condenser of unknown capacity, three condenser of known capacity (1 µF, 2 µF and 3 µF), resistance of the order of few mega ohm, neon and argon flashing bulb, stabilized D.C. power supply of 220 volt, three one way key, connecting wire.

Procedure:

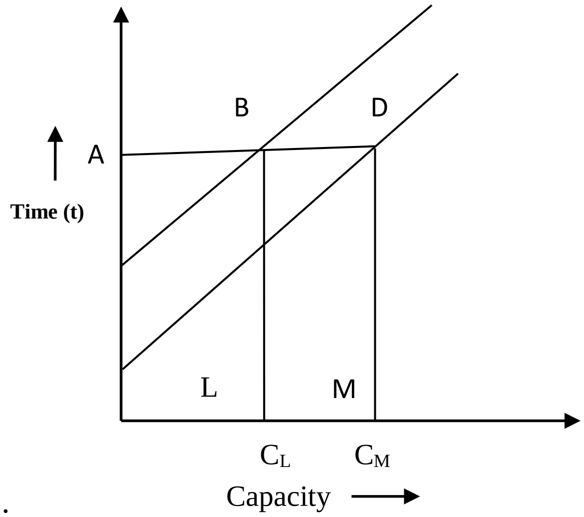
1. Draw the diagram showing the connections as in the figure make the connection with all the condensers in the parallel with a separate key to operate and high resistance are in series with the circuit containing power supply with stabilized output of 220 V DC.
2. Connect the condenser C_1 (1 µF) in the circuit by inserting S_1 also connect the key to power supply and increase the voltage till neon lamp just begin to flash. The bulb starts flashing and quenching as it is connected in parallel with the condenser.
3. Note the flashing and quenching time for 20 flashes. The power supply disconnected.
4. Connect the unknown capacity C_0 so the C_0 and lamp are in parallel their capacities get added and total capacity with parallel with the lamp is (C_1+ C_0). Again adjust the power supply voltage again to the sum value as in previous case note the time for 20 flashes. Remove the key S_1
5. Repeat the experiment with the capacity C_2(2 µF) alone (C_2+ C_0) and C_3(3 µF) alone (C_3+C_0) then repeat the experiment with known capacities C_1, C_2, C_1+C_2+C_3 and each time taking time for 20 Flashes.

Circuit Diagram:

Observation Table:

S.No.	Known Capacity (μF)	Time for 20 flashes	
		Without C_0 (sec.)	With C_0 (sec.)
1.	C1		
2.	C2		
3.	C3		
4.	C4 = C1+C2		
5.	C5 = C2+C3		
6.	C6 = C1+C2+C3		

Calculations:
Draw two graphs on the same scale and on the graph paper. One between C and t and and other between C and t. They will be parallel lines as shown. Now draw a line ABD parallel to X-axis as shown, where they cut the graphs, draw BL, DM parallel to Y-axis is shown. Now the unknown capacity is given by:
(a) C0 = CL – CM = ….. μF



Result: The Capacitance of unknown capacitor is……

Precautions:

1. Count the number of flashes very carefully.
2. Connections should be tight.
3. Capacitors should always be connected parallel to lamp.

Experiment No: 09

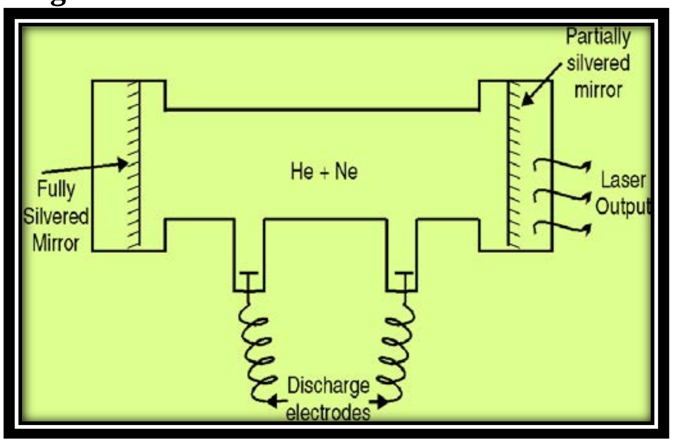
Aim: To find the wavelength of He - Ne laser source.

Apparatus Required: He-Ne laser source, two uprights with micrometer, laser screen, and graph paper, optical bench of laser source etc.

Formula Used:

The wavelength of He-Ne laser is given by the formula: $\lambda = \frac{\beta d}{D}$
Where β = fringe width. D = Distance between slit and the screen, λ = wavelength of He-Ne laser source
d = distance between two slits.

Diagram:



Procedure:

1. Mount the double slits on the uprights and place near the laser.
2. Adjust the position of the screen and the double slit to get a clear parallel fringe pattern on the screen.
3. Note the fringe pattern on the graph paper from the screen.
4. Find the distance between the slit and screen and also find the distance between the two slits.

5 Now change the distance between the source and the slits and record the pattern formed on the screen.
6 After recording the pattern find the distance between every two consecutive pattern and then find the mean fringe width.
7 After finding the value of mean fringe width we will calculate the value of wavelength of He-Ne laser source.

Observation Table For fringe width:

Distance between the source and the screen (D) = ….cm.
Distance between the two slits (d1 and d2) = …………cm

S.No	Distance between slit and screen (D)	Distance between two slit (d)	Fringe width (β)
1			
2			
3			
4			

Result: The wavelength of Laser beam is …….Å.

Precautions and Sources of Error:

1. The slit must be narrow and close to each other as laser beam is very thin.
2. Keep the distance of the screen on the eyepiece from the slit sufficiently large to observe measurable fringe width.
3. Slit should be adjusted for a vertical position and very near the beam coming from the laser source.

Experiment No. 10

Aim: To calculate the wavelength of the various color of white light with the help of plane transmission diffraction grating.

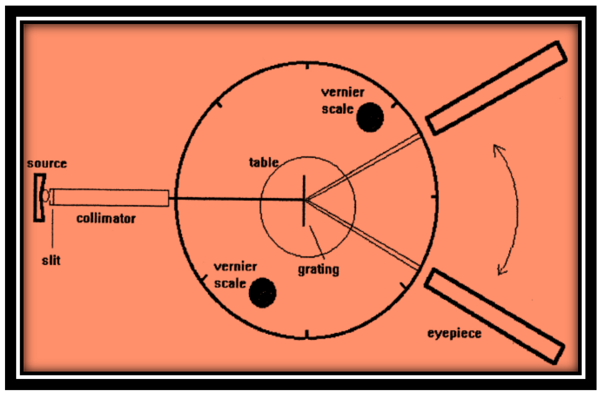
Apparatus Required:

Spectrometer, diffraction grating element and mercury vapor lamp, Magnifying glass.

Formula Used:

$$\boldsymbol{\lambda} = \frac{(\boldsymbol{a}+\boldsymbol{b})\boldsymbol{sin\theta}}{\boldsymbol{n}}$$ Where (a+b) = grating element and n is order of spectrum

Diagram:



Procedure

1. The preliminary adjustments of the spectrometer are made.
2. The grating is mounted vertically on the prism table with its ruled surface facing the collimator.
3. The leveling screws are adjusted so that the image is at the center of the field of view of the telescope
4.
   The telescope is focused in such ways that direct image can view in the field of telescope. On the either side of the direct image, the diffraction spectra are seen.
5. The telescope is turned slowly towards the left so that the vertical cross wire coincides with the violet lines of the first order. The readings of the vernier are taken. The vertical cross wire is then made to coincide with the other lines on the left and the vernier readings are taken in each case.
6. The telescope is then moved to the right and the reading of different lines is similarly taken. The difference between the readings on the left and right on the same vernier is determined for each line. The mean value of this difference gives 2θ-twice the angle of diffraction.
7. Thus the angle of diffraction θ for each spectral line is determined. The wavelength of the green line is 546.1 x10^{-9}m. The number of lines per meter (N) of the grating is calculated. Using this value of N, the wavelengths of the other prominent lines in this spectrum are calculated.

Observation:

Color of light	Order of spectrum	Kind of Vernier	Reading of telescope for left hand side Spectrum			Reading of telescope for right hand side Spectrum			2θ=(x-y)	Mean θ in deg
			MSR	VSR	Total (x) =MSR+VSR x (LC)	MSR	VSR	Total (y)		
Violet	First	V_1								
		V_2								
Green	First	V_1								
		V_2								
Red	First	V_1								
		V_2								

Calculation:

Wavelength of Prominent Light is given by**:** $\boldsymbol{\lambda = \frac{(a+b)sin\theta}{n}}$

Result: Observed (Mean) wavelength of Violet =………………… Å

Percentage Error:

$$\frac{\text{Standard Value – Observed Value}}{\text{Standard value}} x\ 100 = \text{………..\%}$$

Precaution:

1. Before performing the experiment the spectrometer should be adjusted properly.
2. Grating should be set normal to the incident light.
3. Grating should not be touched by figure.
4. While taking observations telescope and prism table kept fixed**.**