Laboratory Manual
B.Sc. 1st Year

Honours Physics

RPS DEGREE COLLEGE

BALANA (MAHENDERGARH) 123029

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Experiment: 1

Aim:

To draw the static current-voltage (I-V) characteristics of a junction diode

Apparatus:

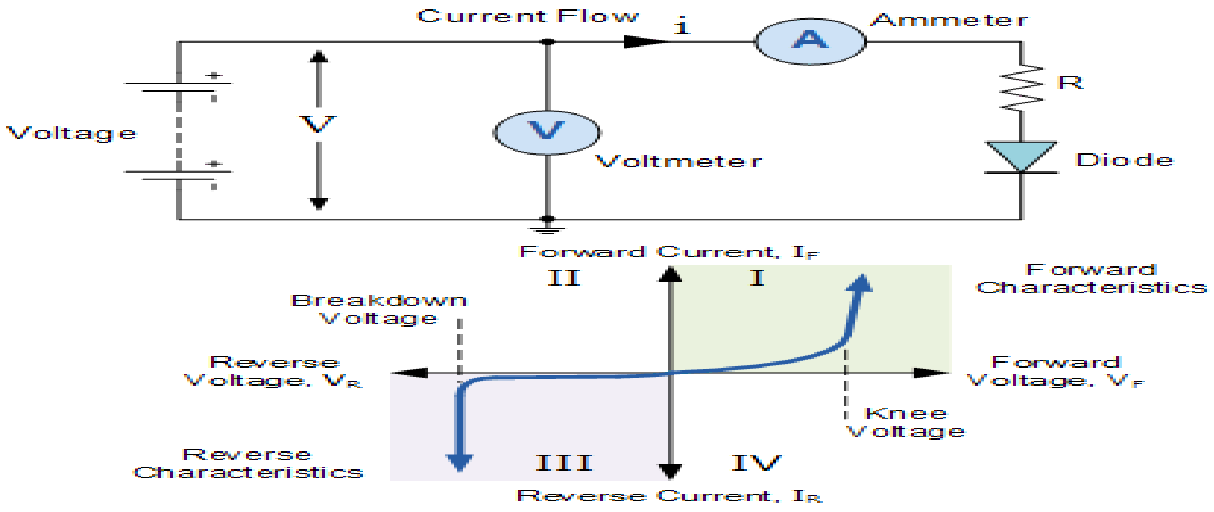
Diode, resistor, variable DC power supply, millimetre, voltmeter, Rheostat and wire

About experiment:

A diode, in electronics, is a two terminal electronic component with asymmetric transfer characteristics, with low resistance to current flow in one direction and high resistance to current flow in the other direction. A semi-conductor diode is the most common type diode, which is a piece of semi-conductor material with a p-n junction connected to two terminals.

A diode allows electric current to pass in forward direction and block current in reverse direction. The behaviour of a diode in a circuit is given by its I-V characteristics. The shape of the curve is determined by the transport of charge carriers through the depletion layer that exist at the p-n junction. When a p-n junction is first created, diffusion of holes and electrons take place through the junction. As recombination proceeds, more ions are created at the junction and a built-in potential is developed at the depletion zone.

If a voltage of same polarity as that of built-in potential is applied across the junction, depletion zone acts as an insulator, preventing significant current flow through the junction. This is the reverse bias phenomenon.



Procedure:

(A) For forward bias characteristics:

1. Using millimeter and a voltmeter. Check your connections.
2. Adjust the position of the variable contact of the rheostat (or the potentiometer) so that the voltmeter reads zero. Now increase the voltage in small steps of about 0.1 volt each and note the reading of voltmeter and the corresponding reading of milliammeter.
3. Plot a graph between forward voltage V_F and forward current IF by taking V_F along x-Axis and IF along y-axis.
4. Draw a tangent on V_F - IF curve and find its slope. Reciprocal of slope gives the Forward resistance of the diode.

(B) For reverse bias characteristics.

5. Complete the electric circuit as shown in fig (b).
   Using micro ammeter and 15 volt voltmeter. Check the connections.
6. Starting with zero voltage increase the reverse voltage in steps of 1 - 2 volts reach and note the reading of voltmeter as well as the corresponding readings of micro ammeter.
7. Plot a graph between reverse voltage V_R and IR taking V_R along x-axis and IR along y-axis.

Observations:

S.	**Forward biasing**		**Reverse biasing**	
	Voltage V_f	**Current I (mA)**	**Voltage V_R**	**Current IR (µA)**
I. 2. 3. 4. 5.				

Precautions:

1. Connections in forward and reverse bias arrangement should be thoroughly checked and voltmeters and milliammeter of appropriate range should be used.
2. Voltages applied should not be so high and should be within safety limit of given diode.
3. The current drawn from semiconductor diode in forward bias should not exceed its current carrying capacity. A suitable resistance of about 100 ohm may be applied in series of the diode circuit.
4. For determining resistance, so use only the middle smooth portions of the characteristic curves.

Result:

The forward and reverse bias characteristics of given semi-conductor diode are attached herewith.
The forward bias resistance of the given diode = ………. ohm
The reverse bias resistance of the given diode =……….. ohm

EXPERIMENT-2

Aim:

To determine the moment of inertia of a flywheel

Apparatus:

Fly wheel, weight hanger, slotted weights, stop watch, meter scale.

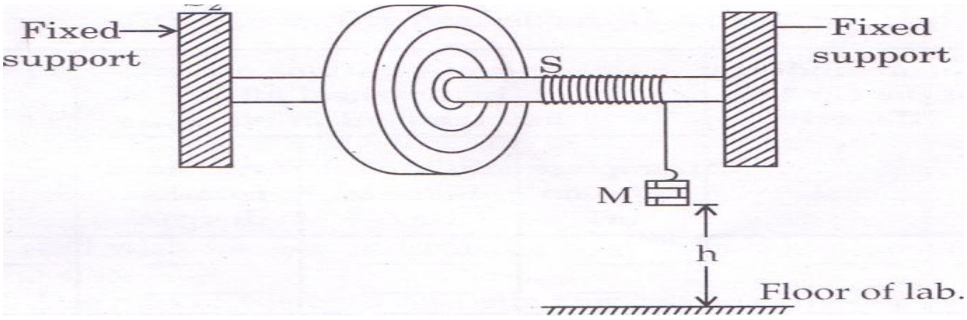
Formula used:

$$I = \frac{Nm}{N+n}\left(\frac{2gh}{\omega^2} - r^2\right) \qquad (4)$$

Where, I = Moment of inertia of the flywheel assembly
N = Number of rotation of the flywheel before it stopped
m = mass of the rings
n = Number of windings of the string on the axle
g = Acceleration due to gravity of the environment.
h = Height of the weight assembly from the ground.
r = Radius of the axle.

About experiment:

The flywheel consists of a heavy circular disc/massive wheel fitted with a strong axle projecting on either side. The axle is mounted on ball bearings on two fixed supports. There is a small peg on the axle. One end of a cord is loosely looped around the peg and its other end carries the weight-hanger.



Procedure:

1. The length of the cord is carefully adjusted, so that when the weight-hanger just touches the ground, the loop slips off the peg.
2. A suitable weight is placed in the weight hanger
3. A chalk mark is made on the rim so that it is against the pointer when the weight hanger just touches the ground.
4. The other end of the cord is loosely looped around the peg keeping the weight hanger just touching the ground.
5. The flywheel is given a suitable number (n) of rotation so that the cord is wound round the axle without overlapping.
6. The height (h) of the weight hanger from the ground is measured.
7. The flywheel is released.
8. The weight hanger descends and the flywheel rotates.
9. The cord slips off from the peg when the weight hanger just touches the ground. By this time the flywheel would have made n rotations.
10. A stop clock is started just when the weight hanger touches the ground.
11. The time taken by the flywheel to come to a stop is determined as t seconds.
12. The number of rotations (N) made by the flywheel during this interval is counted.
13. The experiment is repeated by changing the value of n and m.

Observations

Mass suspended (m) $\times 10^{-3}$ kg	Height above the ground (h) $\times 10^{-2}$ m	No. of revolutions		Time for N revolution (t) s	Mean ang:vel: $\omega=4\pi N/t$	M.I of the Fly wheel (kgm²)
		n	N			

Result

Moment of inertia of the fly wheel =.........kgm^2

EXPERIMENT-3

Aim:

Moment of Inertia of an irregular body using a torsion pendulum

Apparatus:

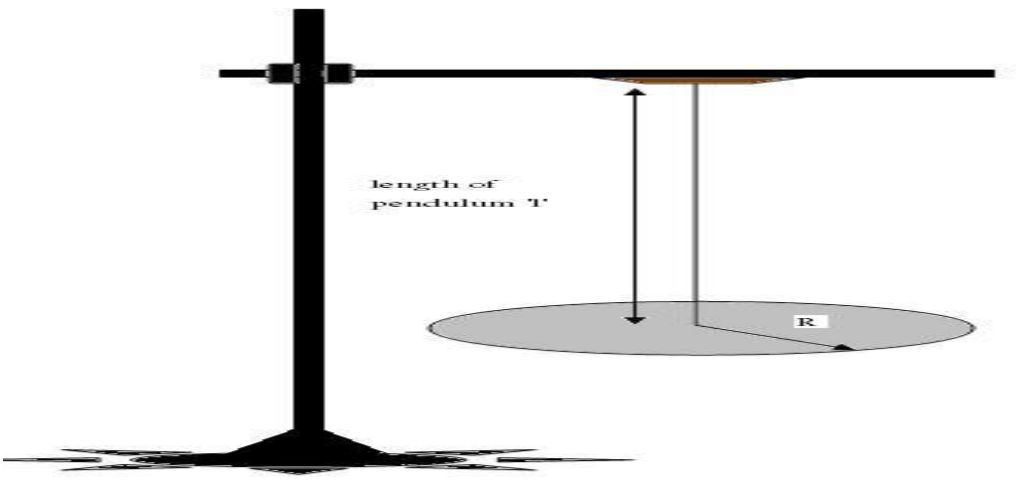
The given torsional pendulum, two identical cylindrical masses, stops watch, metre scale, etc.

Formula used:

$$I_0 = 2m\left(d_2^{\,2} - d_1^{\,2}\right)\frac{T_0^{\,2}}{\left(T_2^{\,2} - T_1^{\,2}\right)} = \ldots\ldots\ldots\ldots kgm^2$$

About experiment:

A body suspended by a thread or wire which twists first in one direction and then in the reverse direction, in the horizontal plane is called a torsional pendulum. The first torsion pendulum was developed by Robert Leslie in 1793.



Procedure:

1. The radius of the suspension wire is measured using a screw gauge.

2. The length of the suspension wire is adjusted to suitable values like 0.3m,0.4m,0.5m,.....0.9m,1m etc.
3. The disc is set in Oscillation. Find the time for 20 oscillations twice and determine the mean Period of oscillation ' T_0 '.
4. The two identical masses are placed symmetrically on either side of the suspension wire as Close as possible to the centre of the disc, and measure d_1 which is the distance between the Centres of the disc and one of the identical masses.
5. Find the time for 20 oscillations twice and determine the mean period of oscillation ' T_1 '.
6. The two identical masses are placed symmetrically on either side of the suspension wire as Far as possible to the centre of the disc, and measure d_2 which is the distance between the Centres of the disc and one of the identical masses.
7. Find the time for 20 oscillations twice and determine the mean period of oscillation ' T_2 '.
8. Find the moment of inertia of the disc using the given formulae.

Observations:

Length of the suspension wire=................m

Radius of the suspension wire=..............m

Mass of each identical masses=.............kg

d_1=...........m

d_2=...........m

Length of the suspension wire 'l'(m)	Time for 20 oscillations in seconds									Period of oscillation (s)			$T_0^2/(T_2^2-T_1^2)$	$l/(T_2^2-T_1^2)$ (ms^{-2})
	Without mass			With masses at d_1			With mass at d_2			T_0	T_1	T_2		
	1	2	Mean	1	2	Mean	1	2	Mean					

Calculations:

$T_0 =$........s

$T_1 =$. ....s

$T_2 =$.........s

Moment of inertia of the given disc,

$$I_0 = 2m\left(d_2^2 - d_1^2\right)\frac{T_0^2}{\left(T_2^2 - T_1^2\right)} = \ldots\ldots\ldots\ldots kgm^2$$

Result:

Experiment-4

Aim:

To construct a Zener diode voltage regulator and measure its line and load regulation

Apparatus

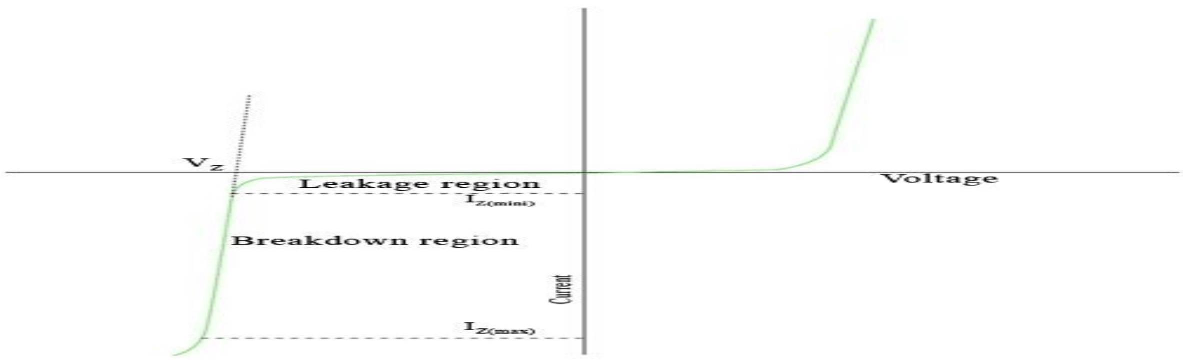
Zener diode, resistor, variable DC power supply, milliammeter, voltmeter, Rheostat and wire.

About experiment:

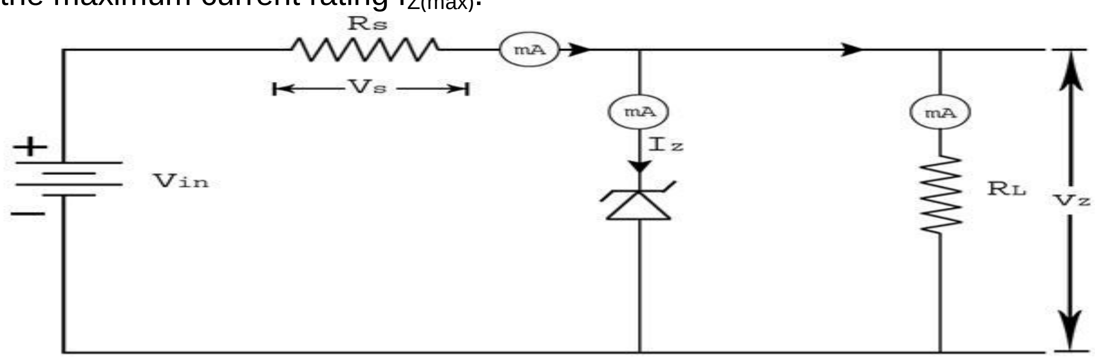
The Zener diode is like a general-purpose signal diode. When biased in the forward direction it behaves just like a normal signal diode, but when a reverse voltage is applied to it, the voltage remains constant for a wide range of currents.

Avalanche Breakdown: There is a limit for the reverse voltage. Reverse voltage can increase until the diode breakdown voltage reaches. This point is called *Avalanche Breakdown* region. At this stage maximum current will flow through the Zener diode. This breakdown point is referred as "Zener voltage".

The Zener Diode is used in its "reverse bias". From the I-V Characteristics curve we can study that the Zener diode has a region in its reverse bias characteristics of almost a constant negative voltage regardless of the value of the current flowing through the diode and remains nearly constant even with large changes in current as



long as the Zener diodes current remains between the breakdown current $I_{Z(min)}$ and the maximum current rating $I_{Z(max)}$.



Procedure:

1. Complete the connections as shown in the circuit diagram. Be sure that the Zener diode is connected in reverse bias.
2. Introduce a fixed resistance (100 to 500 ohm) in series of diode and keep it constant throughout the experiment. Introduce a resistance of about 2000 ohm from the resistance box being used as the load resistance.

3. Change the input voltage in small steps from low voltage to well above the Zener voltage of given diode. For each value of input voltage note the reading of output voltage across the load resistance.
4. Plot a curve between input voltage (along x axis) and output voltage (along y-axis). We see that after a certain value, output voltage does not increase with the increase in input voltage. The constant output voltage gives us the value of Zener voltage of given diode.
5. Keep the input voltage more than the Zener voltage. Starting from about 50 ohm, increase the load resistance in steps of 50 - 100 ohms and note the corresponding values of output voltage.
6. Plot a graph between load resistance (along x-axis) and the output voltage (along y-axis).
   From this graph we see that initially the output voltage increases with increase in load resistance but after a certain value of load resistance the output voltage remains constant and does not change with further increase of load resistance.

Observations:

(A) Table to study variation in output voltage with input voltage:

Fixed series resistance R_s = ... ohm

Fixed load resistance R_L = ... ohm

B) Table to study variation in output voltage with

Sr. No.	Input Voltage (Volts)	Output voltage (Volts)
1.		
2.		
3.		
4.		
5.		
6.		
7.		

Load resistance:

Fixed series resistance R_S = ... ohm

Fixed input voltage = ... volt.

Sr.no No.	Load resistance (ohm)	Output voltage (volt)
1.		
2.		
3.		
4.		
5.		
6.		
7.		

Calculations:

Plot graphs between (i) variation of output voltage V with input voltage, and (ii) variation of output voltage V with load resistance and observe their nature.

Precautions:

1. The Zener diode must be connected only in reverse bias configuration.
2. A suitable resistance should be connected in series with the Zener diode so that current flowing through the diode does not exceed its safe limit.
3. While studying the variation of output voltage with variation of load, the input voltage should be kept constant throughout the observation set.

Result:

Experiment-5

Aim:

To determine ‘g’ by Bar Pendulum

Apparatus used:

Bar pendulum, stop watch and meter scale.

Formula used:

Acceleration due to gravity,

$$g = 4\pi^2 \frac{L}{T^2}$$

Where L is the equivalent length of the bar pendulum corresponding to the period T

About experiment:

Galileo was the first person to show that at any given place, all bodies – big or small – fall freely when dropped, with the same (uniform) acceleration, if the resistance due to air is negligible. . The gravitational attraction of a body towards the centre of the earth results in the same acceleration for all

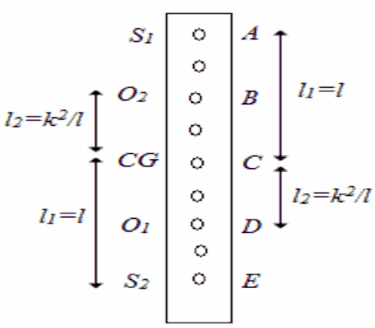


Fig.1

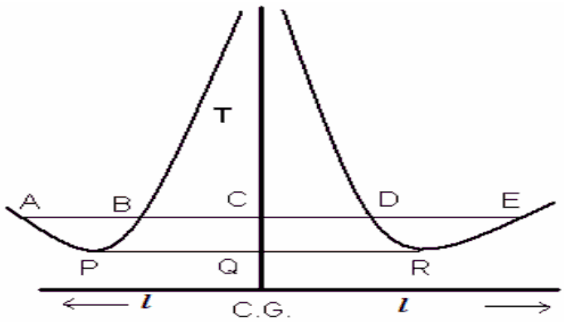


Fig. 2

Procedure:

(1) Place the knife-edges at the first hole of the bar.
(2) Suspend the pendulum through rigid support with the knife-edge.
(3) Oscillate the pendulum for small amplitude (θ=3~40).
(4) Note the time taken for 20 oscillations and measure the distance of the hole
(5) Repeat the observations (2)-(4) for knife-edges at first half side holes of bar
(6) Repeat the process (1)-(5) for the second half side of the bar from the C.G. of the bar.
(7) Plot the graph between T and L.

Observations:

1. Least count of the stop watch = ….. Sec
2. Least count of the meter scale =…… cm

Table for l and T

S. No.	No. of hole	On side of centre of Gravity (Knife edge A)				On other side centre of gravity (Knife edge A)			
		Time for 20Vibrations in sec.			Time period in sec.	Time for 20Vibrations in sec.			Time period in sec.
		1	2	Mean		1	2	Mean	
1									
2									
3									
4									
5									
6									
7									
8									

Calculations:

L= (AD+EB)/2=…., T=…sec,

k=PR/2=… T_{min}=…sec

l_1= (AC+CE)/2=…., l_2= (BC+CD)/2

Precautions:

1. The motion of the pendulum should be in a vertical plane. While taking the time, start taking observations after two oscillations to avoid any irregularity of motion.
2. The amplitude of oscillation should be small.

Results:

The acceleration due to gravity (g) = ……….m/s^2

Radius of gyration (k) = ………cm (from calculation)

=………cm (from graph)

Experiment: 6

Aim:

To calibrate the wire of Carey –Foster's bridge and hence determine the value of a given low resistance (say the resistance of two turns of tangent galvanometer).

Apparatus:

Carey-Foster's bridge, two equal low resistances (value 2 - 5 ohm), a fractional resistance box (range 0.1 -1 ohm), a cell, a sensitive galvanometer, jockey, thick copper strip, one way key, thick connecting wires and given low resistance of unknown value.

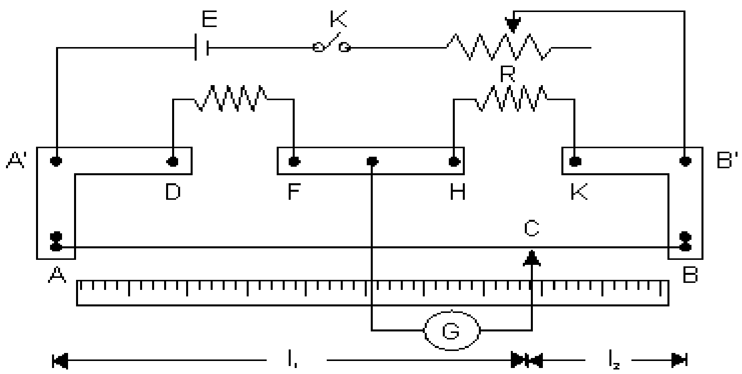
Formula used:

$$\sigma = \frac{r}{(l_2 - l_1)}$$

Where r =resistance drawn from resistance box

About experiment:

Two resistances to be compared, X and Y, are connected in series with the bridge wire. Thus, considered as a Wheatstone bridge, the two resistances are X plus a length of bridge wire, and Y plus the remaining bridge wire. The two remaining arms are the nearly equal resistances P and Q, connected in the inner gaps of the bridge.



The Meter Bridge
Fig. 14.4

Procedure:

1. Draw a circuit diagram as shown in fig (a) clean the ends of the connecting wires and thick copper strip using a sand paper.
2. Complete the electric connections as shown in fig. (a). Join the fractional resistance box in extreme left gap (marked as X) and the thick copper strip in extreme right gap (marked as Y in fig. (a). Use thick copper wires of shortest possible lengths to connect the fractional resistance box as

well as the resistances P and Q. Check the connections once again.

3. To test the connections, make all the plugs of the fractional resistance box tight and insert plug in key K. Gently touch the jockey on the bridge wire at one end (say M) and note the direction of deflection in galvanometer. Now touch the jockey at the other end marked as N of bridge wire and again note the direction of galvanometer deflection. If the direction of deflection is now opposite then the electrical connections are correct else recheck your connections. Now slide the jockey on the bridge wire and obtain the position of null point. If the null point is obtained at the middle of wire i.e. at 50 cm length, it is alright otherwise tighten all the terminals as well as all the plugs of resistance box so that the null point is obtained at almost 50 cm mark.
4. Now take out 0.1 ohm plug from the fractional resistance box joined in extreme left gap (i.e. r = 0.1 ohm) and slide the jockey on bridge wire so as to obtain the null point position. Note the distance *tl'* of the null point from zero end of wire.
5. Take out the plug from key K. Interchange fractional resistance box and thick copper strip (i.e. join resistance box in extreme right gap and copper. strip in left gap). Put the plug in key K. Slide the jockey on bridge wire and obtain the length 1_2' for new position of null point. Calculate the value of resistance per unit length *a.* Find the mean value of *a* from these observations.
6. Repeat the step no. 4 and 5 (above) by taking 0.2, 0.3 ohm etc. resistance from fractional resistance box and find a.

Observations:

For resistance per unit length '0' of the bridge wire:

Sr. No.	Resistance inserted from Resistance box (r) in ohm	Position of balance point with resistance box joined in (in cm)		$l_2 - l_1$ in cm	$\sigma = \frac{r}{l_2 - l_1}$ In ohm cm^{-1}
		left gap l_1	right gap l_2		
1.	0.1				
2.	0.2				
3.	0.3				
4.	0.4 .				
5.	0.5				

B) For low resistance Y:

S. No.	Resistance inserted from resistance box (R) in ohm	Position of balance point with resistance box joined (in cm)		$(l_2 - l_1)$ In cm	Y=R – $(l_2 - l_1)\sigma$ ohm
		left gap l_1	right gap l_2		
1.	0.1				
2.	0.2				
3.	0.3				
4.	0.4				
5.	0.5				

Precautions:

1. The ends of the connecting wires, thick copper strip and the copper leads should be properly cleaned using sand paper.
2. The fractional resistance box and the unknown low resistance should be connected to the bridge by thick copper leads of shortest possible length.
3. All the plugs of the resistance box should be tight.
4. The jockey should be touched with wire gently and should just touch the wire while being moved along.
5. The difference between X and Y should not be more than the resistance of bridge wire otherwise it will not be possible to obtain the balance point.
6. In order that the bridge may have high sensitiveness, the resistances of the four arms should be of the same order.
7. The bridge wire must be of uniform cross section area.
8. The cell circuit should be closed only when the readings are to be taken.
9. While checking for null point, the cell circuit must be completed before pressing the jockey attached in galvanometer circuit on the wire.

Result:

Experimentally determined value of given low resistance = ...ohm

Experiment: 7

Aim:

To determine the given high resistance by substitution method.

Apparatus:

Sensitive galvanometer, a high resistance of the order of 0.5 - 1.0 mega ohm, a mega ohm box, a resistance box, one way key, battery, connecting wires etc

Formula used:

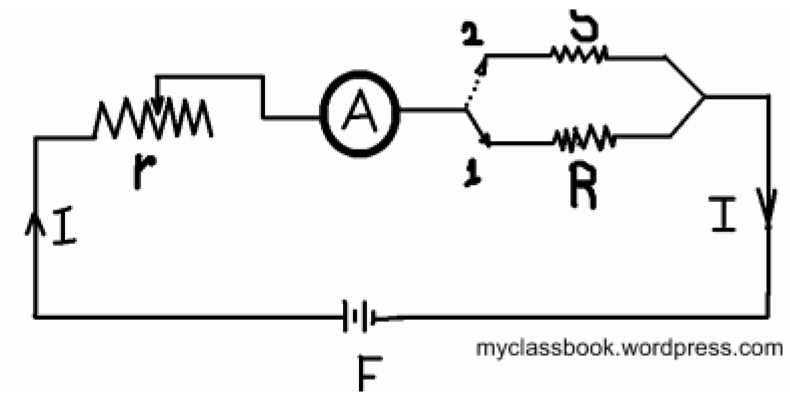
(i) For galvanometer resistance'

$$G = \frac{RS}{R-S}$$

Where R is the resistance inserted from mega ohm resistance box joined in main circuit and S is the shunt resistance.

About experiment:

R is the unknown resistance to be measured, S is the standard variable resistance, ‘r’ is the regulating resistance and ‘A’ is an ammeter. There is a switch for putting S and R in a circuit.



Firstly switch is at position 1 and R is connected in a circuit. The regulating resistance ‘r’ is adjusted till ammeter pointer is at chosen scale. Now switch is thrown to position ‘2’ and now ‘S’ is in a circuit. The value of standard variable resistance ‘S’ is varied till the same deflection as was obtained with R in the circuit is obtained. When the same deflection obtained it means same current flow for both the resistances. It means resistances must be equal. Thus we can measure the value of unknown resistance ‘R’ by substituting another standard variable resistance ‘S’. Therefore this method is called Substitution method

Procedure:

1. accordingly and complete the electrical circuit using connecting wires of appropriate lengths but before joining the key in the circuit, plugs should be removed from the keys. Compare the circuit connections with the circuit diagram and see that the connections made are correct and tight.

   Setting of galvanometer

2. Release the clamp provided at the back of galvanometer so that the coil is free to vibrate.

   Adjust the leveling screws provided at the base of galvanometer till the coil can move freely.

3. Adjust the scale provided so that its extremities are equally distant from the mirror of galvanometer. Now place the eye in front of the slit provided on the scale to observe the image of the scale in the mirror fixed to the suspension strip in the galvanometer. Adjust height of the scale such that image of the scale is clearly visible in the mirror.
4. Turn \the torsion head of the galvanometer very slowly till zero mark on the image coincides with the image of central reference mark observed in the fixed mirror attached on the front panel of galvanometer. Fix the torsion head in this position. Now the galvanometer is ready for use.

   Determination of galvanometer resistance

5. Put a suitable resistance R from mega ohm box and put in the plug between the terminals marked 1 and 3 in two way key K. Note the deflection of the galvanometer. The deflection should be large enough but within the scale.
6. Also insert the plug in key K, and adjust the resistance S taken from the shunt resistance box till the deflection of the galvanometer is exactly half i.e. %. Apply the formula and find the value of G.
7. Repeat the step no. 5 and 6 three times find and then mean value of galvanometer resistance G.

Observations:

A) For galvanometer resistance (G):

S. No.	Resistance R {in ohm}	Initial deflection, θ	Half deflection, $\frac{\theta}{2}$	Shunt S (in ohm)	RS G= $\frac{RS}{R-S}$ (in ohm)
1. 2. 3.					

Mean value of galvanometer resistance, G = ...ohm

(B) For unknown high resistance (X):

S. No.	Deflection with X (in cm)	R (in ohm)	S (in ohm)	Deflection (in cm)	X=$\frac{S+G}{S}$ (in ohm)
1. 2. 3.					

Mean value of given high resistance, X = … ohm

Precautions:

1. A sensitive suspended type moving coil galvanometer should only be used.
2. The resistance of galvanometer should be high (a few hundred ohms). **If** galvanometer resistance is too low then Join a resistance of appropriate value in series with the galvanometer. In such case G

is the total resistance of galvanometer and the resistance added in its series.

3. The galvanometer should be set carefully. Always clamp the suspended end when the galvanometer is not in use.
4. The unknown high resistance, the galvanometer and the connecting wires should be carefully insulated so as to avoid any leakage of current.

Result:

Observed value of given high resistance, X = ...ohm

Experiment: 8

Aim:

To determine the impedance of an ac. circuit and verify the relation

APPARATUS:

Inductance (L), capacitor (C) and resistance (R), digital millimeter variable step down transformer, a.c. voltmeter and a.c. millimeter of suitable range, one way key and flexible wires

Formula used:

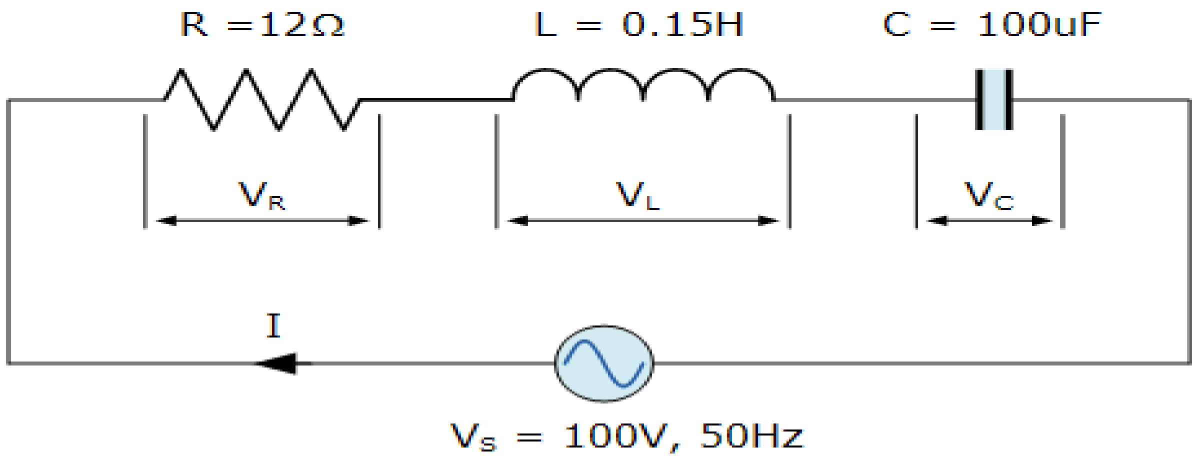
The impedance of ac. circuit is given b

$$Z = \frac{V_{rms}}{I_{rms}} = \sqrt{R^2 + (X_L - X_C)^2}$$

Where
V_{rms} = effective or rms voltage across the source or series LCR combination
effective or rms current in LCR series circuit
R =Total ohmic resistance (including resistance of the inductor).
X_L = Inductive reactance ($X_L = \omega L$)
X_C=Capacitive reactance
(X_c=1/ωC)

About experiment:

we have seen that the three basic passive components: resistance (R), inductance (L), and capacitance (C) have very different phase relationships to each other when connected to a sinusoidal AC supply. In a pure ohmic resistor the voltage waveforms are “in-phase” with the current. In a pure inductance the voltage waveform “leads” the current by 90°, giving us the expression of: ELI. In a pure capacitance the voltage waveform "lags" This *Phase Difference, Φ* depends upon the reactive value of the components being used and hopefully by now we know that reactance, (X) is zero if the circuit element is resistive.



PROCEDURE:

1. Using multimeter, measure the dc resistance of the inductor.
2. Make the electrical connections as shown in Fig. 14.1 using flexible connecting wires.
3. Keeping the variable transformer at its lowest voltage, switch on the ac. mains.
4. Increase the voltage from the transformer so that milliammeter shows some suitable readings.
   Note the value of current. Also measure potential difference across LCR series combinations inductor (L), capacitor (C) and resistance (R). Let their values be represented by $E_{eff} > E_L$, E_c and E_R.

Make the necessary calculations to obtain the values of X_L, X_C Rl' R and ultimately Z and Z'.

OBSERVATIONS:

Resistance (dc.) of inductor, r = …..Ohm (using digital multimeter)
Least count of ac millimeter = …….. mA
Zero error of ac millimeter = ……………………mA
Least count of ac voltmeter = …….. V
Zero error of ac voltmeter = …….. V

S.No.	Corrected	Corrected value of P.D. across				$Z = \frac{E_{eff}}{I_{eff}}$	$X_L = \frac{E_L}{I_{eff}}$	$X_c = \frac{E_C}{I_{eff}}$	$R = \frac{E_R}{I_{eff}}$
	Value of Current (I_{eff}) mA	LCR (E_{eff})	(L + R) (E_L)	C (E_C)	R (E_R)				
1. 2. 3.									

Precaution:

1. All the connections should be made using flexible wires.
2. A.C. voltmeter and ac milliammeter of proper range should be used so as to avoid damage to these instruments.
3. Inductor (L), capacitor (C) and resistance (R) of proper rating must be used to avoid their overheating or burning.
4. Naked part of wires or terminals must not be touched with hand to avoid electrical shock.

RESULT:

1. The impedance of the given LCR series circuit is ...... n
2. Z' = Z is verified within limits of experimental errors.

Experiment: 9

Aim:

To verify the inverse square law with the help of a photovoltaic cell

Apparatus:

Photovoltaic cell, optical bench with two uprights, an electric bulb with a bulb housing, sensitive low resistance galvanometer or a sensitive micro ammeter

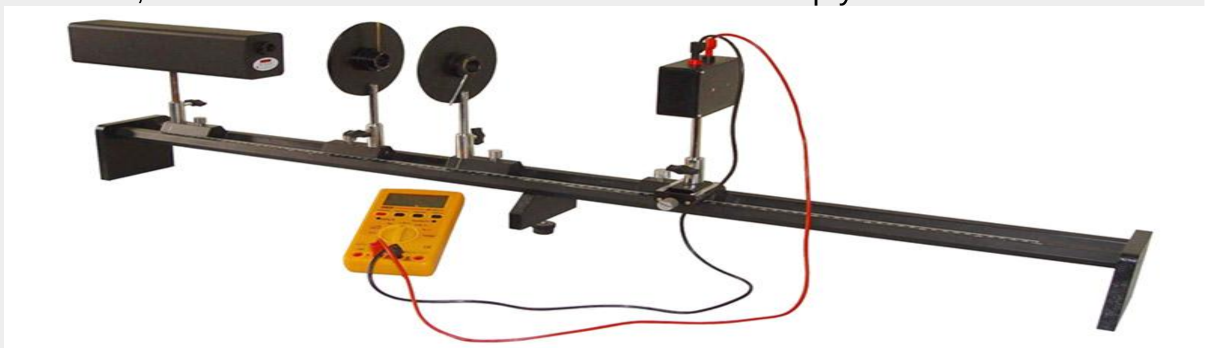
Formula used:

For a source of light having constant luminous intensity and for normal incidence, the intensity of illumination E at a surface is inversely proportional to the square of the distance between light source and the With a very low external resistance the output current of a photovoltaic cell is proportional to the intensity of illumination, hence,

$$\theta \propto \frac{1}{r^2}$$

About Experiment:

This is because you are confusing the intensity of the source with the intensity of a receiver. A photocell works by allowing light into it. The light then gives energy to the electrons in the material. It does this to free the electrons from there bound state, so they can become "conduction electrons" and pass on a current. By "knocking off" the electrons, it reduces the resistance and allows a current to pass. The relationship between the current flowing through the LDR (photocell) is dependent on the reduction in resistance which is independent of the intensity coming in, as it is a discrete process of either giving energy to conduction electrons, or simply not.



Procedure:

1. Inside a dark room place two uprights on an optical bench. One upright should carry an electric bulb and the bulb housing so that a fine collimated light beam comes out of it. The other upright facing it should carry a proper mounting containing a photovoltaic cell.
2. Join a sensitive low resistance galvanometer (or a micro ammeter) to the two terminals of the photovoltaic cell.
3. Adjust the height of lamp housing and the photo cell so that they lie in the same horizontal plane.
4. Adjust the distance of the lamp from the photocell in such a way that when light is allowed to fall on the sensitive portion of photocell, we get maximum possible deflection in galvanometer. Note the position of photo cell as well as lamp and determine the distance r between them. Note the galvanometer deflection e.

5. Move the lamp upright away so that the distance between the photocell and lamp is increased by 5 cm. Again note the deflection in the galvanometer.
6. Increase the distance in steps of 5 cm and note the corresponding galvanometer deflections when light is allowed to fall on photo cell. Take at least six readings.

B. Preferably repeat the experiment by using a bulb of different wattage.

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Observations:

Zero error in galvanometer = ...

S.No.	Position on optical bench (in cm)			$\frac{1}{r^2}$ (cm^{-2})	Deflection θ	
	Upright carrying Photocell (a)	Lamp (b)	Distance r=a-b		Observed	Corrected
I. 2. 3. 4. 5. 6.						

Calculations:

Graph between $1/r^2$ and deflection θ is straight line.

Precautions:

1. Use a low resistance and voltage sensitive galvanometer.
2. The photocell should not be exposed to light continuously.
3. The light from the source should be incident normally on the photosensitive surface.

Result:

The graph between $1/r^2$ and θ is a straight line. **It** shows that deflection (and hence the intensity of Illumination) is inversely proportional to the square of the distance between source and surface. Thus, inverse square law of photometry is verified.