Result:

(i) From $\angle i - \angle D$ graph we see that as $\angle i$ increases, $\angle D$ first decreases, attains a minimum value (D_m) & then again starts increasing for further increase in $\angle i$.

(ii) Angle of minimum deviation = $D_m = 37.8^o$

(iii) Refraction index of material of prism, $\mu = 1.5077$

Precautions:

(i) The angle of incidence should be between $30^o - 60^o$.

(ii) The pins should be fixed vertical.

(iii) The distance between the two pins should not be less than 8 cm.

Sources of Error:

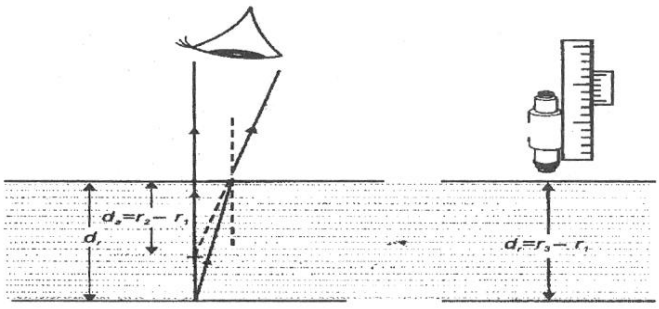
(i) Pin pricks may be thick.

(ii) Measurement of angles maybe wrong.

EXPERIMENT – 12

Aim: To determine the refractive index of a glass using travelling microscope.

Apparatus: A marker, glass slab, travelling microscope, lycopodium powder.



Formulae Used:

Refractive index $\mu = \dfrac{real\ depth}{apparent\ depth} = \dfrac{r_3 - r_1}{r_2 - r_1}$

Observations:

Least count of travelling microscope = 0.001 cm or 0.01 mm

Mean values: $r_1 = 0$ mm $r_2 = 6.81$ mm $r_3 = 10.25$ mm

Observations: Reading of Microscope focused on:

S. No.	Mark without slab r_1 = M + n x LC min	Mark with slab on it r_2 = M + n x LC min	Powder on top of slab R_3 = M + n x LC min
1	0	6.5 + 29 x 0.01 = 6.79mm	10 + 23 x 0.01 = 10.23mm
2	0	6.5 + 31 x 0.01 = 6.81mm	10 + 25 x 0.01 = 10.25mm
3	0	6.5 + 33 x 0.01 = 6.83mm	10 + 27 x 0.01 = 10.27mm

Calculations:

Real depth = $d_r = r_3 - r_1$ = Mean $d_r = 10.25$ mm

Apparent depth = $d_a = r_2 - r_1$

Mean $d_a = 6.81$ mm

$\therefore$ Refractive index, $\mu = \dfrac{real\ depth}{apparent\ depth} = \dfrac{d_r}{d_a}$ $\therefore \mu = 1.52$

Result:

The refractive index of the glass slab by using travelling microscope is determined as 1.52 = μ

Precautions:

(i) Microscope once focused on the cross mark, the focusing should not be disturbed throughout the experiment. Only rack and pinion screw should be turned to move the microscope upward.

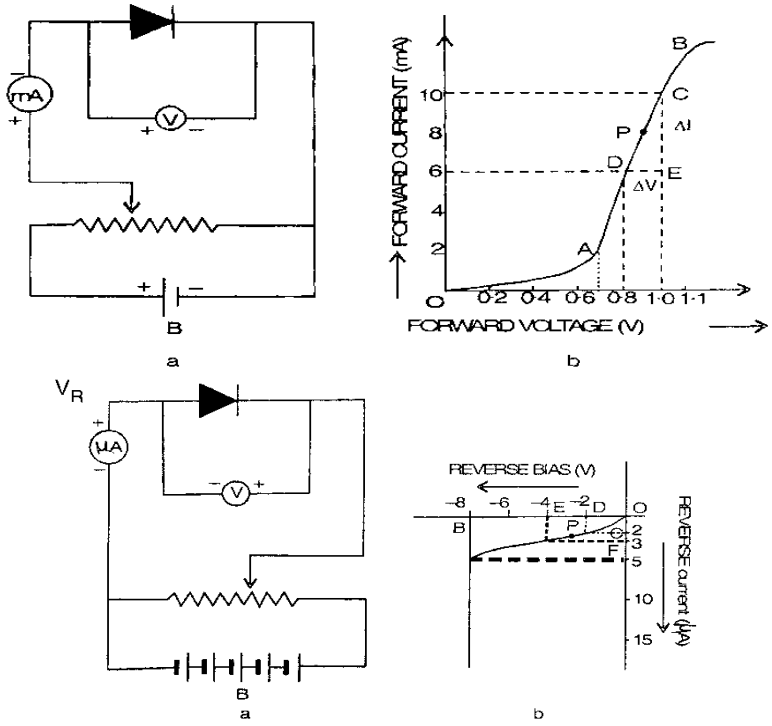
(ii) Only a thin layer of powder should be spread on top of slab.

(iii) Eye piece should be so adjusted that cross-wires are distinctly seen.

EXPERIMENT – 13

Aim: To draw the I – V characteristics curve of *p-n* junction in forward bias & reverse bias.

Apparatus: A *p-n* junction semi-conductor diode, a three volt battery, a high resistance, a rheostat, a voltmeter (0-3v), a milli ammeter (0-.30 mA), one – way key, connecting wires.



Observations:

Least count of voltmeter = 0.02 & 1 v/div Zero error = –

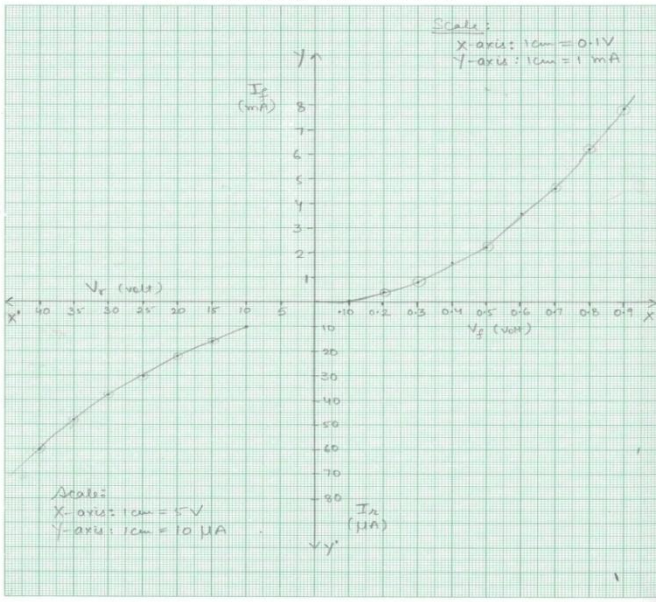
Least count of milli-ammeter = 0.2 mA/div Zero error = –

Least count of micro-ammeter = 2 μ A/div Zero error = –

Observation Table:

S. No.	Forward Bias Voltage (V)	Forward Current (mA)	Reverse bias Voltage (V)	Reverse Current (μ A)
1	10 x 0.02 = 0.20	2 x 0.2 = 0.4	10 x 1 = 10	5 x 2 = 10
2	0.30	4 x 0.2 = 0.8	15	16
3	0.40	6 x 0.2 = 1.6	20	22
4	0.50	11 x 0.2 = 2.2	25	30
5	0.60	18 x 0.2 = 3.6	30	38
6	0.70	23 x 0.2 = 4.6	35	48
7	0.80	31 x 0.2 = 6.2	40	60
8	0.90	39 x 0.2 = 7.8	45	72

I - V Curve for p-n junction diode



Calculations:

Graph is plotted between forward – bias voltage (V_F) (on x-axis) and forward current, I_F (on y – axis)

Scale: X – axis: 1 cm = V of V_F Y – axis: 1 cm = mA of I_F

Graph is plotted between reverse bias voltage, V_R (along X' axis) and reverse current, I_R (along Y' axis).

Scale: X' axis = 1 cm = V of V_R Y' axis = 1 cm = μA of I_F

Result: The obtained curves are the characteristics curves of the semi-conductor diode.

Precautions:

(i) All connections should be neat, clean & tight. (ii) Key should be used in circuit & opened when the circuit is not being used. (iii) Forward bias voltage beyond breakdown should not be applied.

Sources of error: The junction diode supplied maybe faulty.

EXPERIMENT – 14

Aim: To draw the characteristics curves of a zener diode and to determine its reverse breakdown voltage.

Apparatus: One *p-n* junction Zener diode, a power supply with potential divider (0-15V), a resistance of Ω, a micro ammeter of range (0-100 μA), a voltmeter (0-15V), connecting wires.

Theory:

Zener diode: It is a semi conductor diode; in which *n*-type & *p*-type sections are heavily doped i.e. they have more percentage of impurity atoms. It results into low value of reverse breakdown votage (V_{br}).

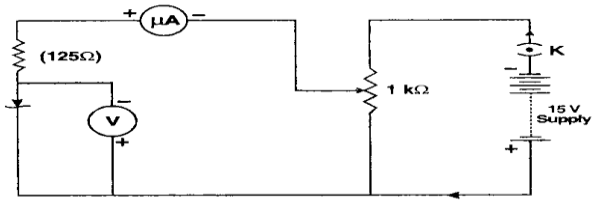


Fig 17.1 : Circuit diagram for plotting characteristic of a Zener diode

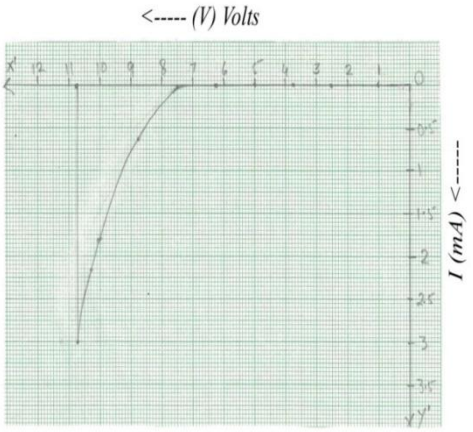
The reverse breakdown voltage of a zener diode is called zener voltage (V_z)- The reverse current that results after the breakdown is called zener current (I_Z).

Circuit Parameters:

V_I = Input (reverse bias) voltage V_o = Output voltage R_I = Input resistance, R_L = Load Resistance

Relation: $I_L = I_I - I_z$ $V_o = V_I - R_I I_I$ $V_o = R_I I_I$

S. No.	Input Voltage V_r = n x LC	Input Current I_r = n x LC (mA)
1	5 x 0.25 = 1.0	0
2	10 x 0.25 = 2.5	0
3	15 x 0.25 = 3.75	0
4	20 x 0.25 = 5	0
5	25 x 0.25 = 6.25	0
6	30 x 0.25 = 7.5	0
7	35 x 0.25 = 8.75	13 x 0.05 = 0.65
8	40 x 0.25 = 10	1.8
9	41 x 0.25 = 10.25	2.25
10	43 x 0.25 = 10.75	3



Initially as V_I increases, I increases a little.

At breakdown, increase of V_I increases I_1 by large amount.

So that $V_o = V_I - R_I I_I$ = constant

This constant value of V_o is called zener voltage (V_z) or reverse breakdown voltage.

Observations: Least count of voltmeter: 0.25 v/div Least count of milli ammeter: 0.05mA/div

Result: From the graph of I_r vs V_r, the reverse breakdown voltage for the zener diode is 10.75V

Precautions: (i) The Zener diode p-n junction should be connected in reverse-bias i.e. p-terminal to –ve and to positive terminal of battery. (ii) Zero error in the instruments should be adjusted in readings.

(iii) Voltmeter & ammeter of appropriate least counts should be used.