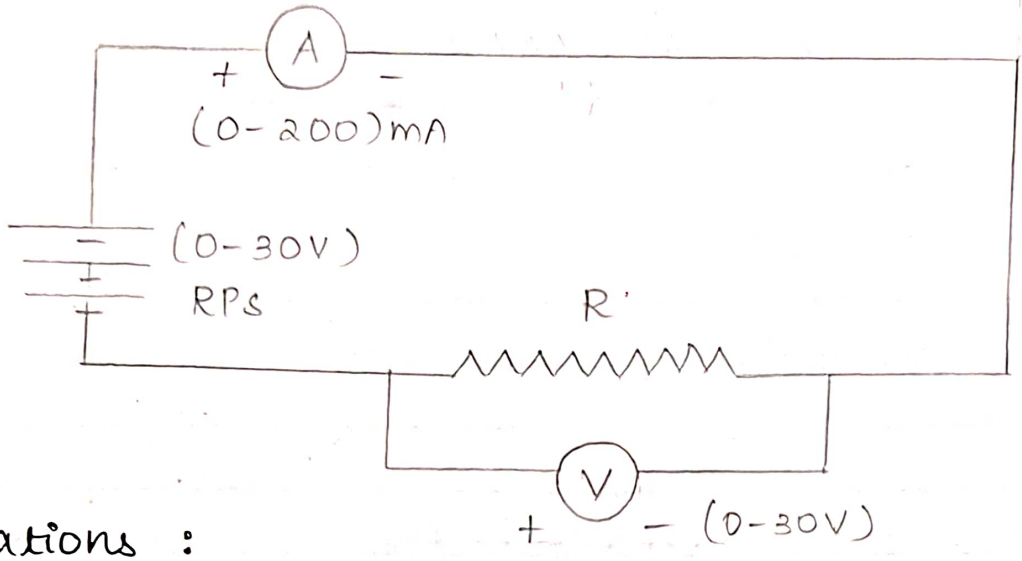
Circuit diagram :



Observations :

S.No	Voltage (V)		Current (mA)	R = V/I in Ω
1.	2V	2V	3.4 mA	588.23 Ω
2.	3V	3V	5.4 mA	555.55 Ω
3.	4V	4.1V	7.4 mA	554.05 Ω
4.	5V	5.2V	9.3 mA	559.13 Ω
5.	6V	6.1V	10.1 mA	603.96 Ω

Model Calculation :

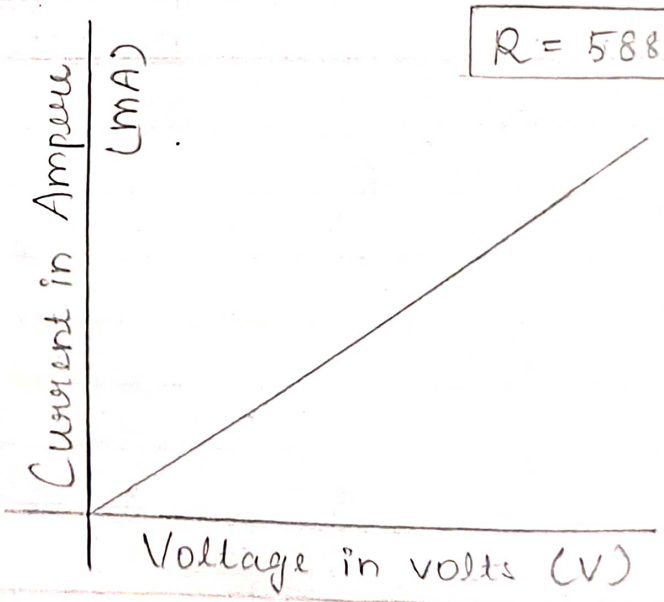
V = 2V

I = 3.4 mA

$R = V/R \Rightarrow \frac{2}{3.4 \times 10^{-3}}$

$R = 588.23\ \Omega$

Model graph :



Ex. 01 Verification of Ohm's law & Kirchoff's Law

1.a) Verification of Ohm's law :

Aim :

To verify Ohm's law for a given resistive network.

Appasatus Required :

S.No.	Appasatus Name	Range	Quantity
1	RPS	(0-30)V	1
2	Ammeter	(0-200) mA	1
3	Voltmeter	(0-30) V	1
4	Resistor	1 KΩ	1
5	Rheostat	300 Ω / 2A	1
6	Bread board and Connecting wires	-	As per the Required

Procedure :

(i) Make the connections as per circuit diagram

(ii) Switch ON the powes supply to RPS and apply the voltage (10 V) and take the reading of V and A.

(iii) Adjust the Rheostat in steps and take down theredings of ammetes and voltmetes.

(iv) Plot a graph with V along x-axis and I (y axis)

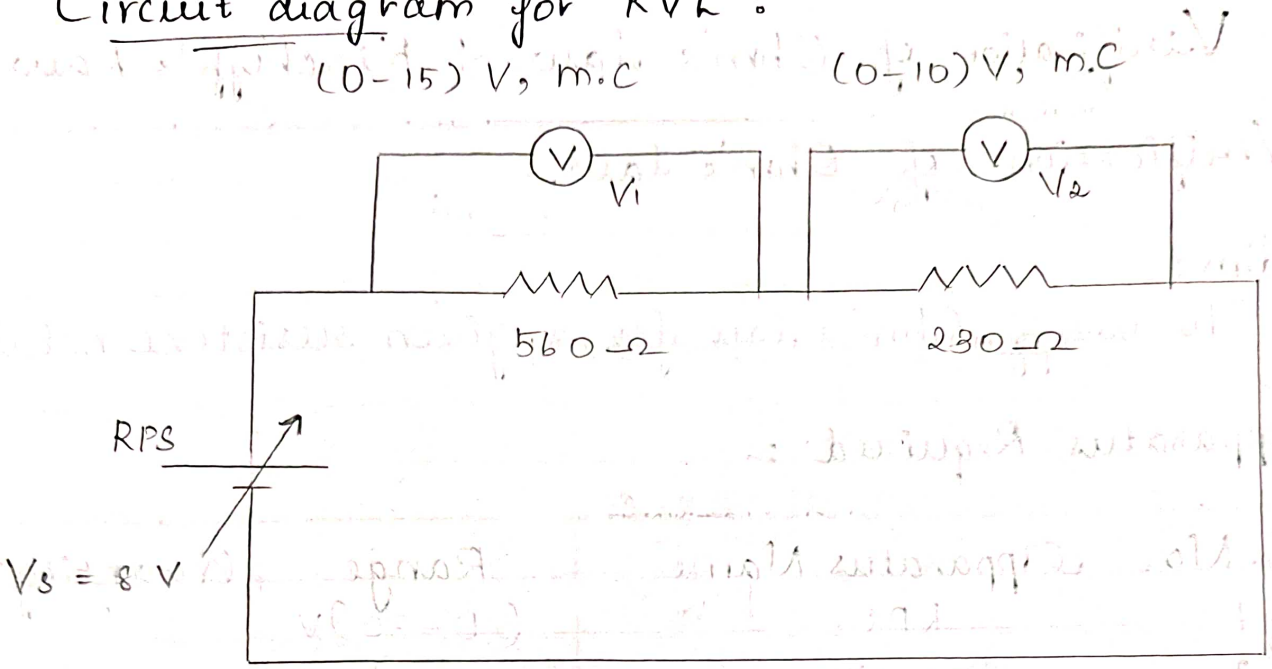
(v) The graph will be a straight line verifies Ohm's law

(vi) Detesmine the slope of V-I graph.

Result :

Thus, the Ohm's law is verified for the given circuit.

Circuit diagram for KVL :



Tabulation for KVL :

Sl. No.	RPS voltage (V)	V1 (volts)		V2 (volts)		V1 + V2 = V	
	RPS in volts	T	P	T	P	T	P
1.	8 V	5.67	5.8	2.32	2	7.99	7
2.	10 V	7.088	7.3	2.911	2.5	9.999	9.8

supply voltage

$V_S = V_1 + V_2 \longrightarrow (1)$

By Voltage division rule,

$$V_{560\Omega} = \frac{8}{(560+230)} \times 560 = \frac{4480}{790} = 5.67\ V$$

$$V_{230\Omega} = \frac{8}{(560+230)} \times 230 = \frac{1840}{790} = 2.32\ V$$

Ex.1.b)

Verification of Kirchhoff's Law

Aim:

1. To verify Kirchoff's voltage law
2. To verify Kirchoff's Current law

Apparatus Required:

S.No.	Name of Equipment	Type	Range	QTY
1	RPS	-		1
2	Bread Board	-		1
3	Ammetes	MC	0-10 & 0-5 mA	1
4	Voltmetes	MC	0-10 & 0-15 mAV	1
5	Resistor	-	470, 330, 4 KΩ & 4.7	1
6	Connecting wires	-	-	20

Procedure:

(i) Connections are given as per the circuit diagram.

(ii) Apply dc voltage to the circuit from the given RPS.

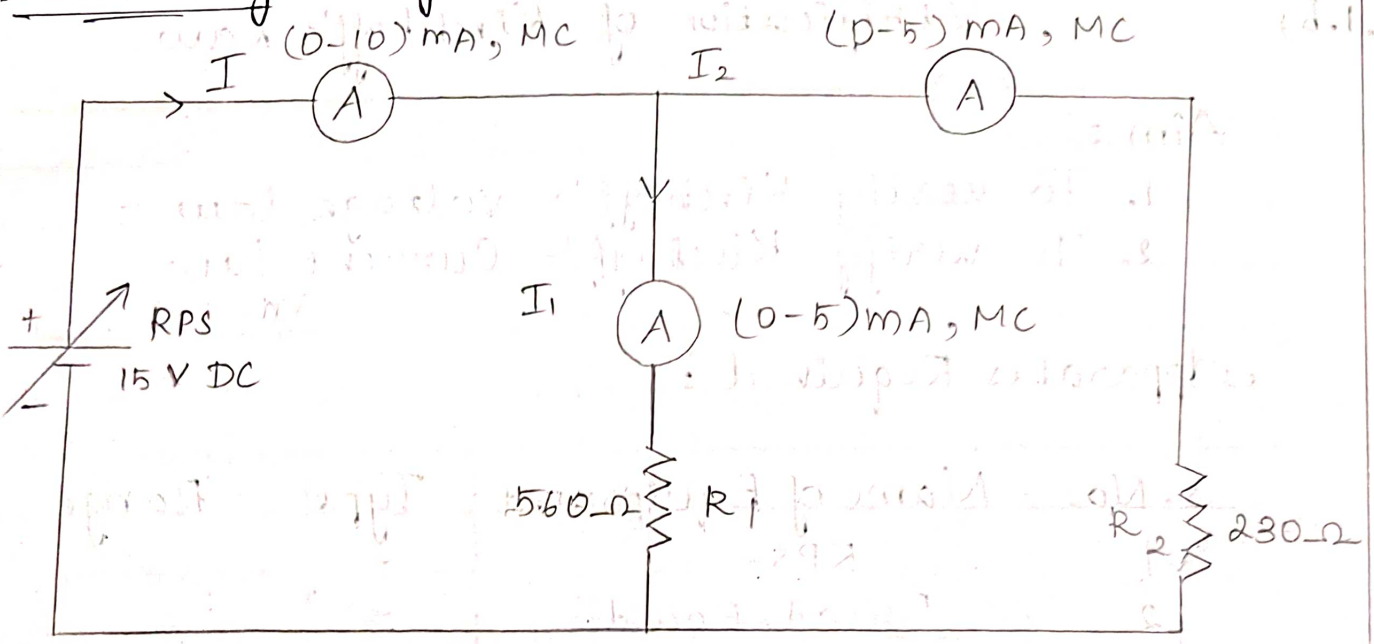
(iii) Tabulate the voltmeters and Ammeters using the reading from the experiment.

(iv) Increase the voltage step by step to get different readings till the voltage reached upto 15 V.

(v) Repeat step 3 for different values.

(vi) Switch off the power supply after bringing RPS to the minimum voltage position.

Circuit diagram for KCL :



Tabulation for KCL :

S.No	RPS (V)	I_1 T	I_1 P	I_2 T	I_2 P	$I_1 + I_2 = I$ T	$I_1 + I_2 = I$ P
1.	8 V	14.3	14.5	34.7	34	49	48.5
2.	10 V	17.8	17.1	43.4	42.9	61.2	61

Model Calculation :

$$R_{eq} = \frac{R_1 R_2}{R_1 + R_2} = \frac{560 \times 230}{560 + 230}$$

$$= \frac{128800}{790} = 163.03\,\Omega$$

$$I_{total} = \frac{V_s}{R_{eq}} = \frac{8}{163.03}$$

$$= 0.049\,A$$

$$= 49\,mA$$

By current division rule,

$$I_1 = \frac{I_{total}}{R_{total}} \times R_{opp}$$

$$= \frac{0.049}{(560 + 230)} \times 230 = 0.0143$$

$$= 14.3\,mA$$

$$I_2 = \frac{0.049}{(790)} \times 560 = 0.0347\,A$$

$$= 34.7\,mA$$

Precautions :

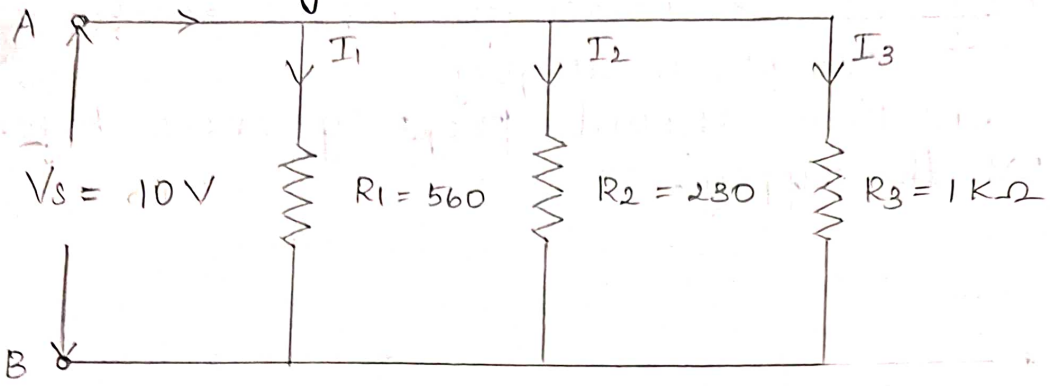
(i) Keep RPS at maximum when switching ON and OFF the power supply.

(ii) Connections should properly check before switch ON the supply.

Result :

Thus, the Kirchoff's voltage and current law is verified for the given circuit.

Circuit diagram :

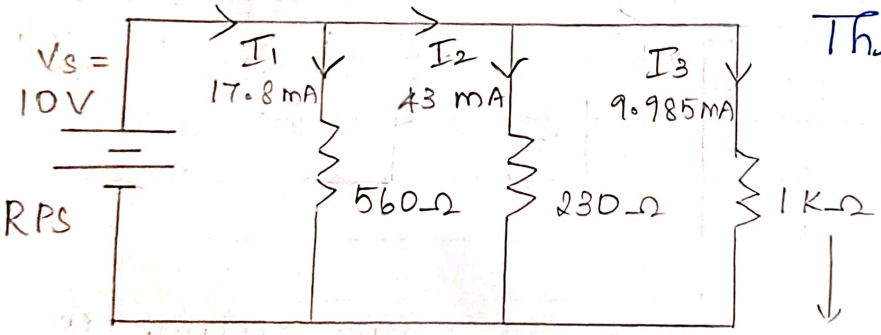


Tabulation :

S.No	RPS voltage (V)	I_1 (mA)		I_2 (mA)		I_3 (mA)		$I_{total} = I_1 + I_2 + I_3$	
		T	P	T	P	T	P	T	P
1.	10 V	17.8	14	43	41	10	7.5	70.8	62.5
2.	5 V	6.8	6.5	19.7	19.5	3.7	3.5	30.2	26

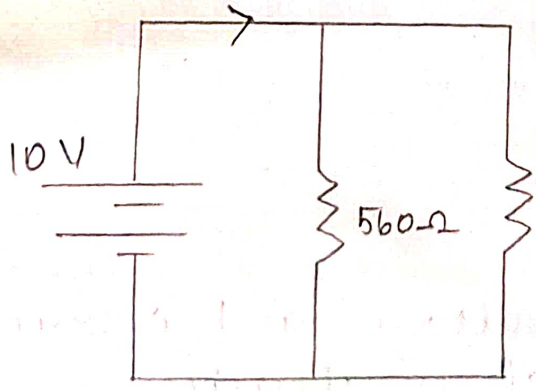
Calculation :

I_{Total} = 71.3 mA (192) / 283 = 53.4 mA



Theoretical diagram

1 KΩ = 1000Ω



$$\text{Parallel} = \frac{230 \times 1000}{230 + 1000} = \frac{230000}{1230}$$

$$= 186.99\ \Omega$$

Ex. 02 Calculation of individual branch current & total current drawn from the powes supply

Aim :

To calculate the individual branch current and total current drawn from the powes supply for the given parallel connected circuit.

Appasatus Required :

S.No	Name of the Item	Range	Quantity
1	Regulated powes	(0-30)V	1
2	supply (RPS)	-	Each 1
3	Rusitors - 330Ω, 1KΩ, 5600	-	3
4	Ammetes	-	1
5	Bread Board	-	-
6	Connecting wires	-	As required

Procedure :

(i) Connect the circuit as pes the circuit diagram.

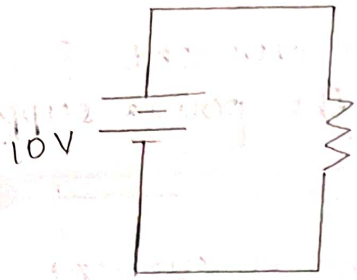
(ii) Apply required value of DC supply voltage using the Regulated powes supply (RPS).

(iii) Note down the readings shown by all the ammeters.

(iv) Repeat the procedure for different value of supply voltages if required.

Result :

Thus, the theoretical values of branch currents are verified practically.



$= \frac{560 \times 186.99}{560 + 186.99} = \frac{104714.4}{746.99}$

$= 140.18\ \Omega$

$R_{eqv} = 140.18\ \Omega$

$I_{total} = \frac{V_s}{R_{eq}} = \frac{10}{140.18} = 0.0713\ A = 71.3\ mA$

By Current division rule,

$I_1 = \frac{I_T}{560 + 186.99} \times 186.99 = \frac{0.0713}{746.99} \times 186.99 = 0.0178\ A$

$= 17.8\ mA$

$I_p = \frac{I_T}{560 + 186.99} \times 560 = \frac{0.0713}{746.99} \times 560 = 0.0534\ A$

$= 53.4\ mA$

By current division rule,

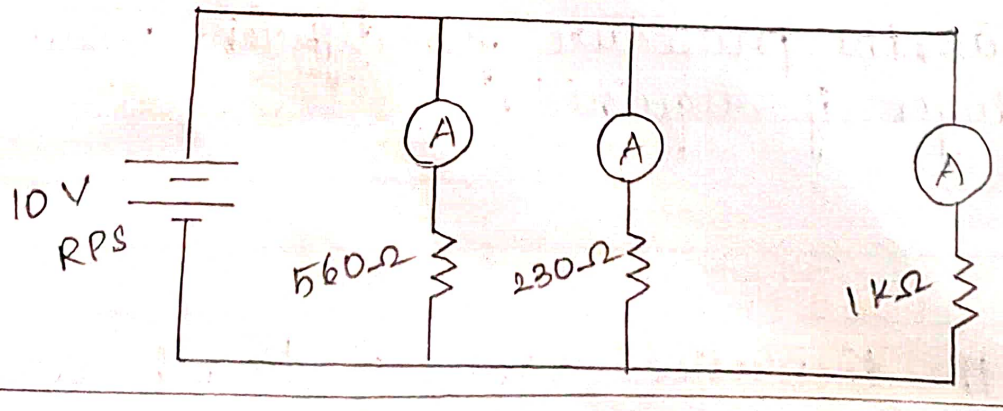
$I_2 = \frac{I_p}{(230 + 1000)} \times 1000 = \frac{0.0534}{1230} \times 1000 = 0.043\ A$

$= 43\ mA$

$I_3 = \frac{I_p}{(230 + 1000)} \times 230 = \frac{0.0534}{1230} \times 230 = 9.985 \times 10^{-3}\ A$

$= 9.985\ mA$

Practical diagram :



Result:

Thus, the theoretical value of Branch currents are verified practically.

Circuit diagram :

Figure 1 :- Forward Bias condition

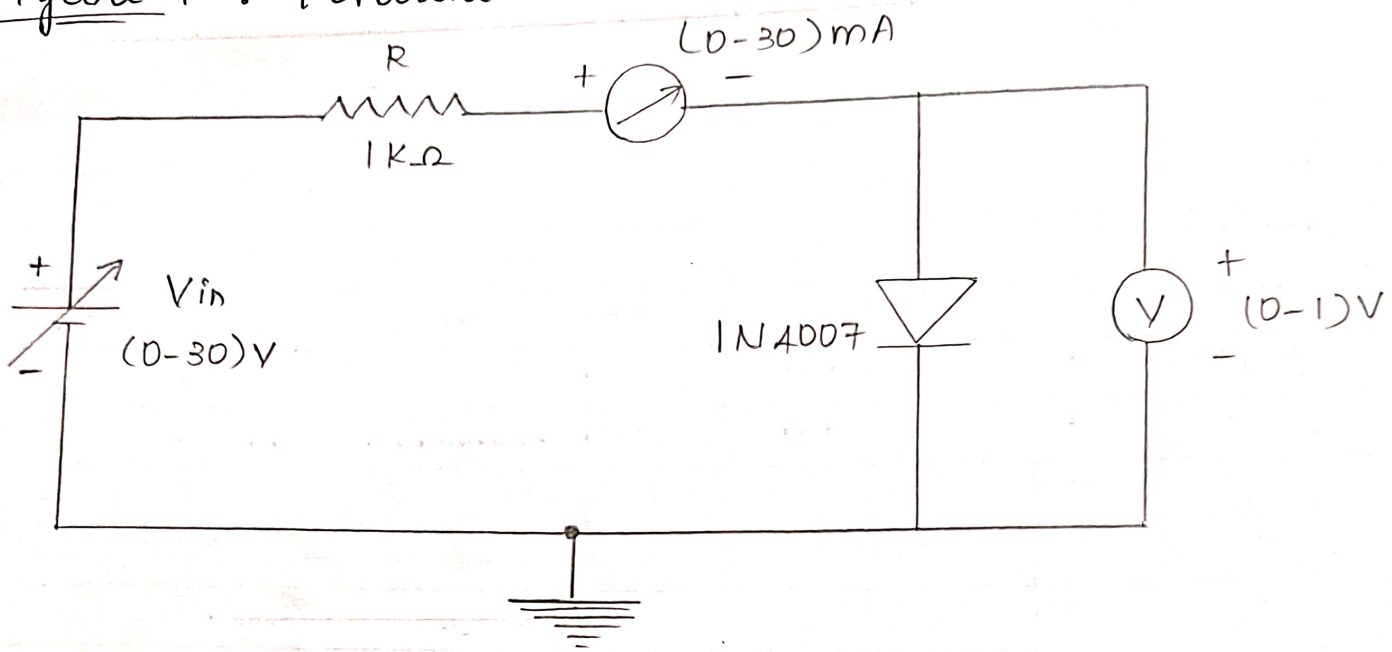
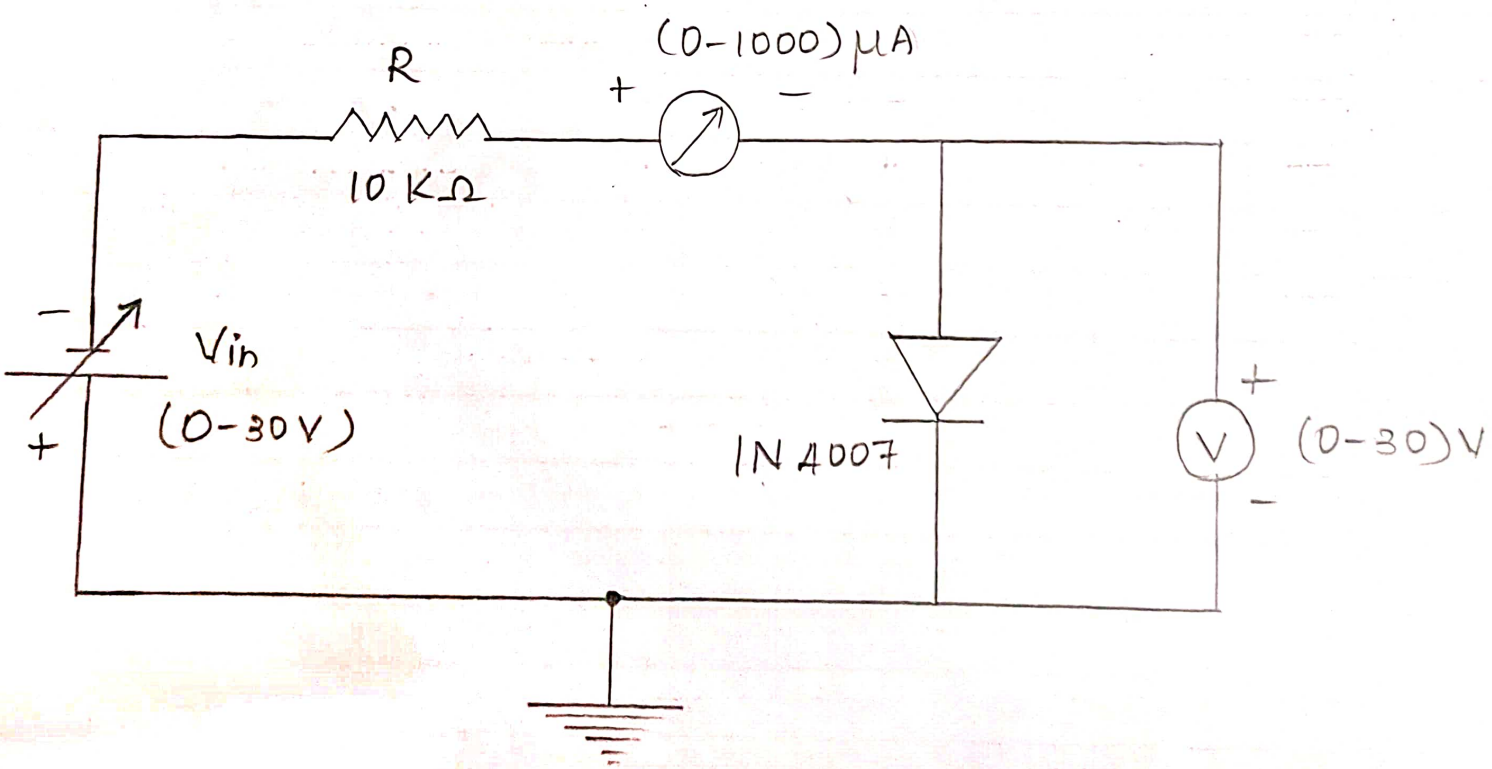


Figure 2 :- Reverse Bias condition



Ex.03

V-I Characteristics of PN Junction Diode

a) **Aim:**

To plot the V-I characteristics of a P-N junction diode in both forward and reverse directions.

Appasatus Required:

Sl.No.	Appasatus	Range	Quantity
1	DC RPS	(0-30) V	1
2	Ammetes	(0-30) mA,	1
		(0-1000) μA	1
3	Voltmetes	(0-1) V,	1
		(0-30) V	1
4	Diode	IN 4007	1
5	Resistor	1KΩ & 10KΩ	1 each
6	Bread board	—	1
7	Connecting wires	—	As required

Procedures:

⇒ **Forward Biased Condition:**

(i) Connections are given as per the figure 1 using the silicon PN junction diode.

(ii) Vary Vf gradually in steps of 0.1 volts and note down the corresponding reading of If.

(iii) Step size is not fixed because of nonlinear curve and vary the x-axis variable.

(iv) Tabulate the different forward currents Obtained for different forward voltages.

Observations :

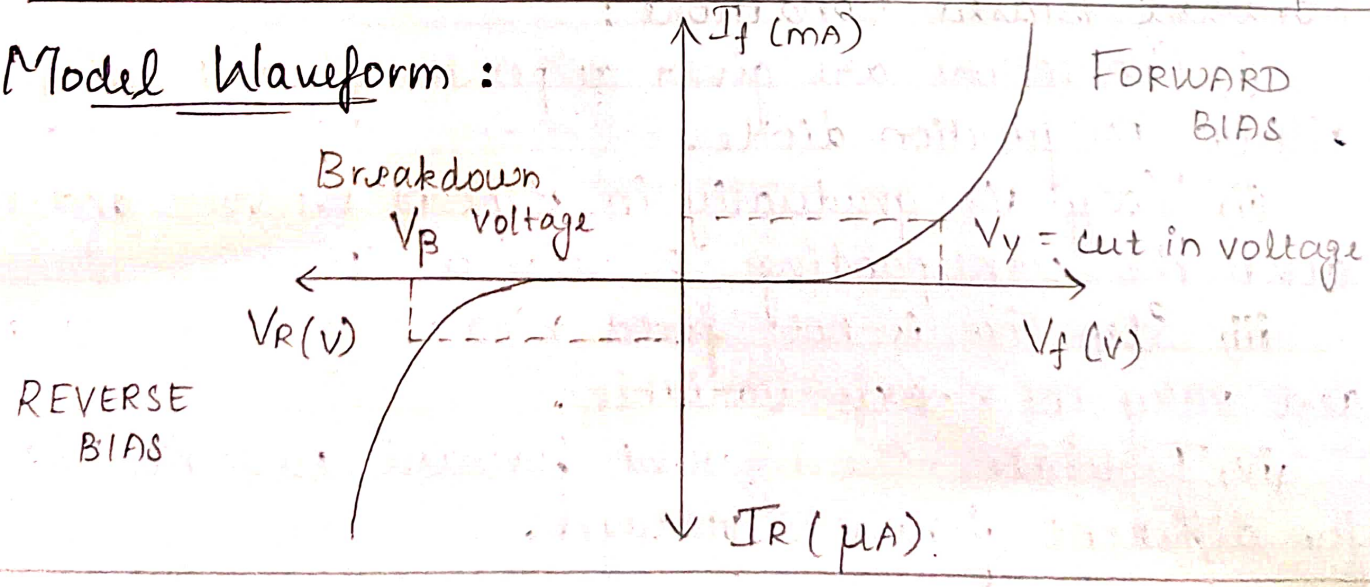
Forward Bias :

Sl. No.	RPS voltage (V)	Forward- V_f (volts)	I_f (mA)
1.	V_f = Forward voltage	0.2	0 mA
2.		0.4	0 mA
3.		0.5	1 mA
4.		0.56	4 mA
5.	I_f = Forward current	0.6	7 mA
6.		0.64	16 mA
7.		0.66	20 mA
8.		0.66	26 mA

Reverse Bias :

Sl. No.	RPS voltage (V)	Reverse- V_R (volts)	I_R (μA)	mA
1.	10 μA to mA	0.5	10	0.010
2.		1	25	0.025
3.		1.5	45	0.045
4.	$= 10 \times 10^{-3}$	2	65	0.065
5.	$= 0.010$	3	95	0.095
6.	I_R = Reverse current	4	130	0.130
7.		6	190	0.190

Model Waveform :



⇒ Reverse Biased conditions :

(i) Connect the circuit as shown in figure 2 using silicon PN junction diode.

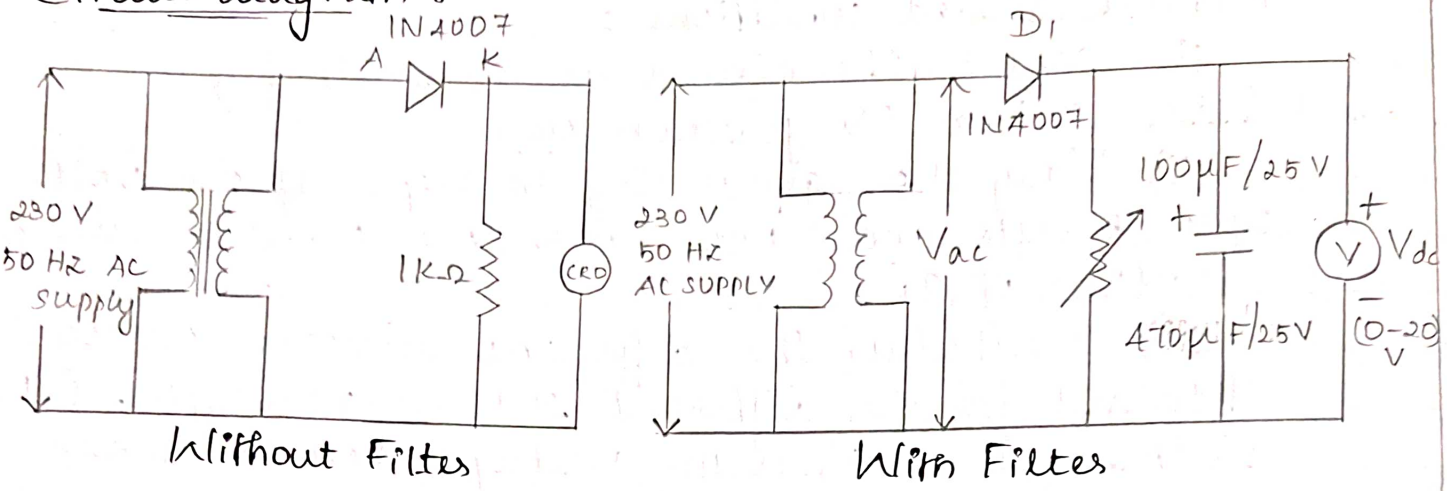
(ii) Vary V_R gradually in steps of 0.5 volts upto 8 volts and note down the corresponding readings of I_R.

(iii) Tabulate the different reverse currents obtained for the different reverse voltages. ($I_R = V_R/R$, where V_R is the voltage across 10 KΩ resistor.

Result :

Thus, the Forward and Reverse bias V-I Characteristics of PN diodes was drawn and Observed.

Circuit diagram :

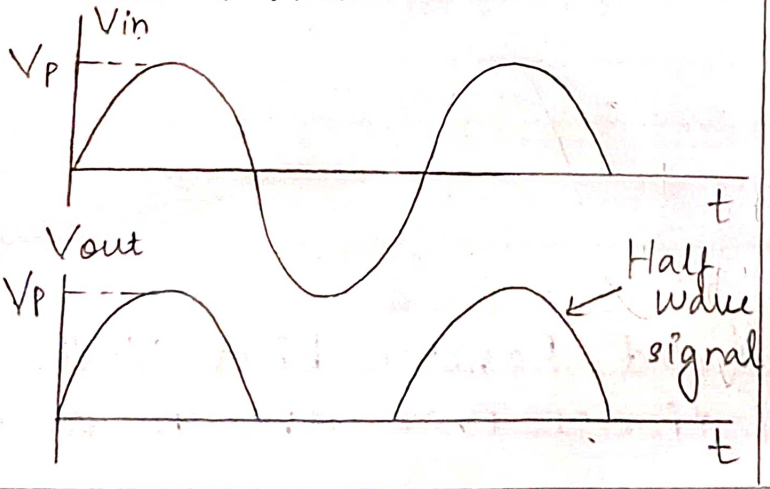


Tabulation :

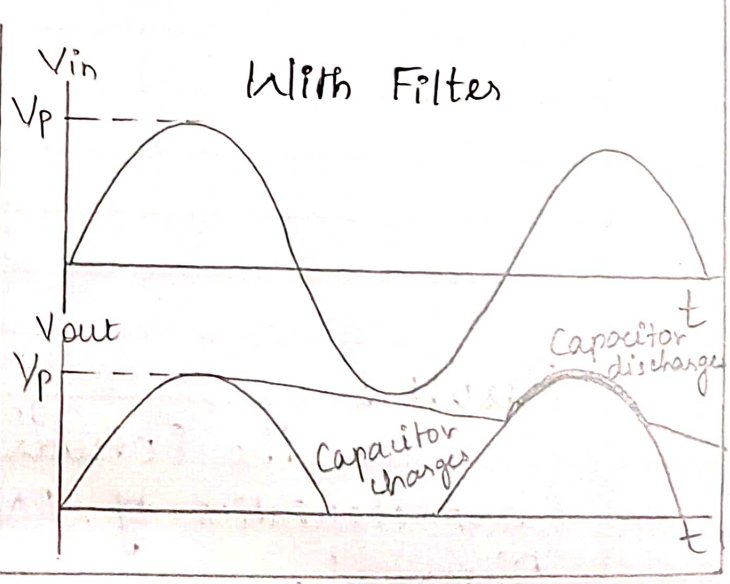
Amplitude	Time period

Output graph :

Without Filter :



With Filter



Ex. 03

Half Wave Rectifier

b)

Aim :

To examine the input and output waveforms of half wave rectifier with and without filter.

Apparatus Required :

Sl. No.	Apparatus	Range	Quantity
1	Diode	IN 4007	1
2	Transformer	6-0-6	1
3	Resistor	1 kΩ	1
4	Connecting wires	–	As required
5	Bread Board	–	1
6	Capacitor	100 μF	1

Procedure :

(i) Connections are made as per the circuit.

(ii) Connect the primary side of the transformer to ac mains and the secondary side to the rectifier input.

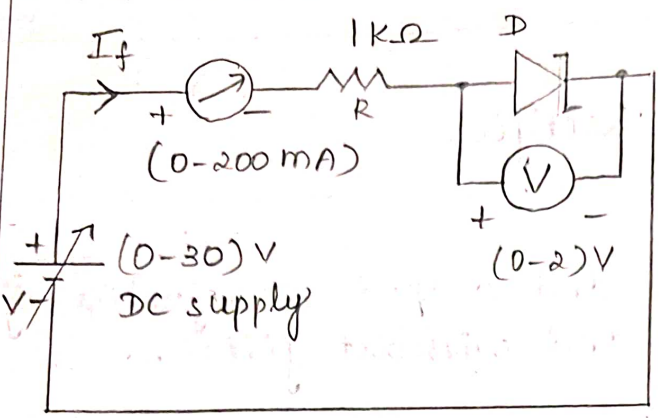
(iii) By the multimeter, measure the ac input voltage of the rectifier and ac, and dc voltage at the output of the rectifier.

(iv) Find the theoretical of dc voltage by using the formula $V_{dc} = V_m/\pi$.

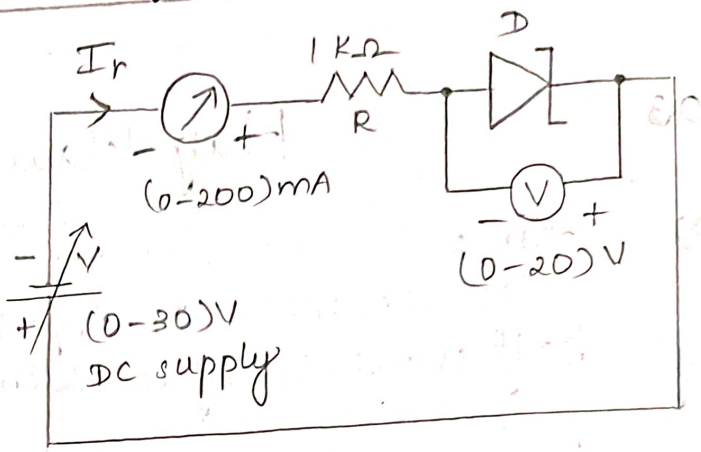
Result :

Thus, the rectified output using half-rectifier is observed and verified.

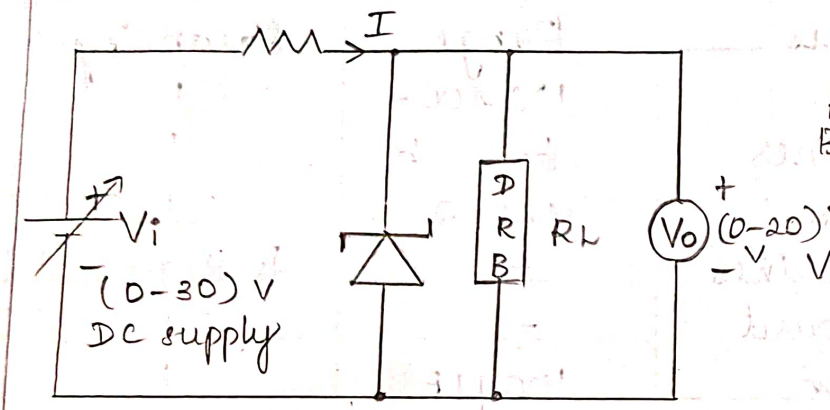
Forward Bias



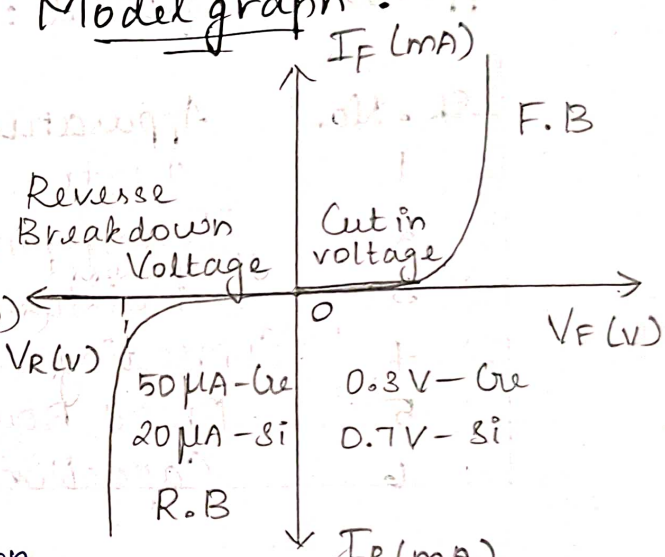
Reverse Bias



Voltage Regulation :

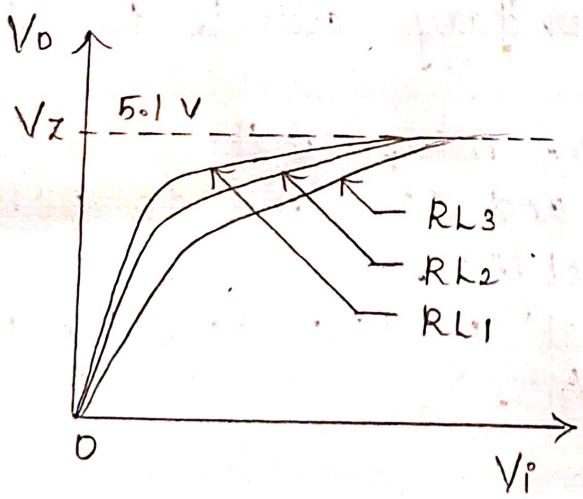


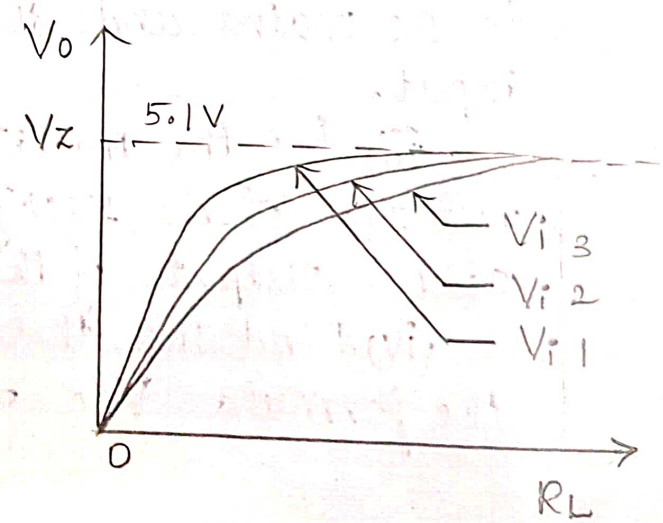
Model graph :



Zener diode Voltage Regulation

Load regulation Characteristics :





Voltage Regulation Characteristics Vi Versus Vo & R_L Versus Vo.

Ex.04 V-I Chasacteristics Zener diode and Zener as Voltage Regulator

a) **Aim :**

(i) To Obtain the forward bias and Reverse bias Chasacteristics of a Zener diode.

(ii) Find out the Zener Break down voltage from the Chasacteristics.

(iii) To obtain the Load Regulation Chasacteristics.

Appasatus required :

S.No.	Name of Appasatus	Range	Quantity
1	DC RPS	0-30 V	1
2	Diode	EC2 5.1	1
3	Resistos	1KΩ, 560Ω	Each 1
4	DC Ammetes	0-200 mA	1
5	DC Voltmetes	0-2V, 0-20V	Each 1
6	Decade Resistance Box	–	1
7	Bread boasd and wires	–	1 set

Procedure :

Forwasd Bias Chasacteristics :

1. Connect the circuit as pes the circuit.
2. Switch on the RPS and slowly increase the sousce voltage.
3. Increase the diode current in steps of 2mA and note dows the corresponding voltage across the Zener diode undes forwasd Bias as pes table given.

Tabulation :

Forward Bias

S.No.	V_F (volts)	I_f (mA)
1	0.2 V	0 mA
2	0.4 V	0 mA
3	0.5 V	0.5 mA
4	0.6 V	0.5 mA
5	0.64 V	1 mA
6	0.68 V	2 mA
7	0.7 V	3 mA
8	0.7 V	10 mA
9	0.7 V	15 mA

Reverse Bias

S.No.	V_R (volts)	I_R (mA)
1	0.5 V	0 mA
2	1 V	0 mA
3	2 V	0 mA
4	3.5 V	0 mA
5	4.5 V	1 mA
6	4.5 V	1.5 mA
7	4.5 V	2.5 mA
8	4.5 V	10 mA
9	4.5 V	15 mA

Line and Load Regulations :

S.No.	R_L (Ω)	$V_{i1} = 5V$ V_o (V)	$V_{i2} = 10V$ V_o (V)	$V_{i3} = 15V$ V_o (V)	V_i (V)	$R_{L1} = 1K\Omega$ V_o (V)	$R_{L2} = 2K\Omega$ V_o (V)	$R_{L3} = 3K\Omega$ V_o (V)

4. Take the readings until a diode current of 20 mA.
5. Plot the graph V_F versus I_F.

Reverse Bias Characteristics:

(i) Connect the circuit as per the circuit diagram.
(ii) Switch on the RPS and slowly increase Vs.
(iii) Increase the diode current in steps of 2mA and note down the corresponding voltages.
(iv) Take the readings until a diode current of 20mA.
(v) Plot the graph V_R versus I_R.

Load Regulation Characteristics:

(i) Connect the circuit as per the circuit diagram
(ii) By changing the R_L, kept constant I/P voltage at 5V, 10V, 15 V as per given table.
(iii) Now, By changing the I/P voltage, kept const. load Resistance at 1K, 2K, 3K as per table.

Zener Breakdown voltage:

Draw a tangent on the reverse bias of the Zener diode starting from the Knee, and touching most of the points of the curve. [Zener Breakdown voltage]

Result:

Thus, the Characteristics of Forward & Reverse bias and the Breakdown voltage are Observed.

Zener Breakdown voltage =
Forward Bias Resistance =
Reverse Bias Resistance =