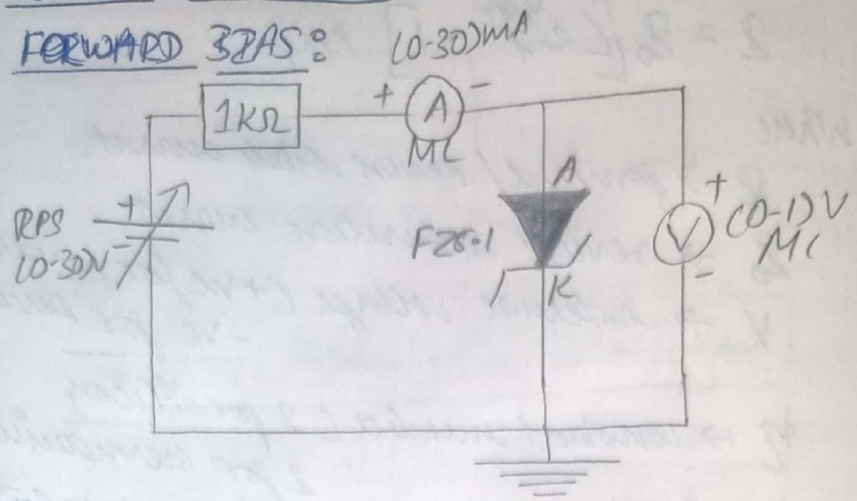
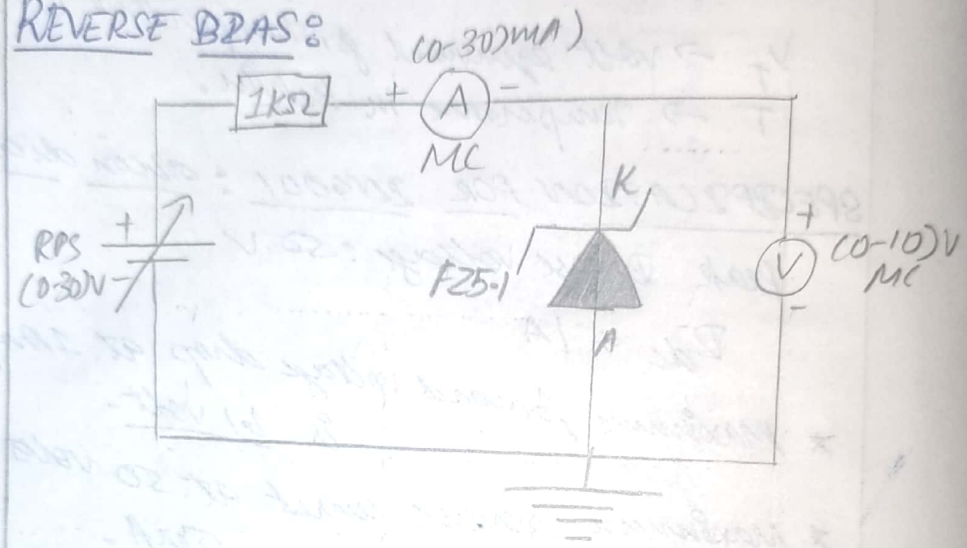
CIRCUIT DIAGRAM:

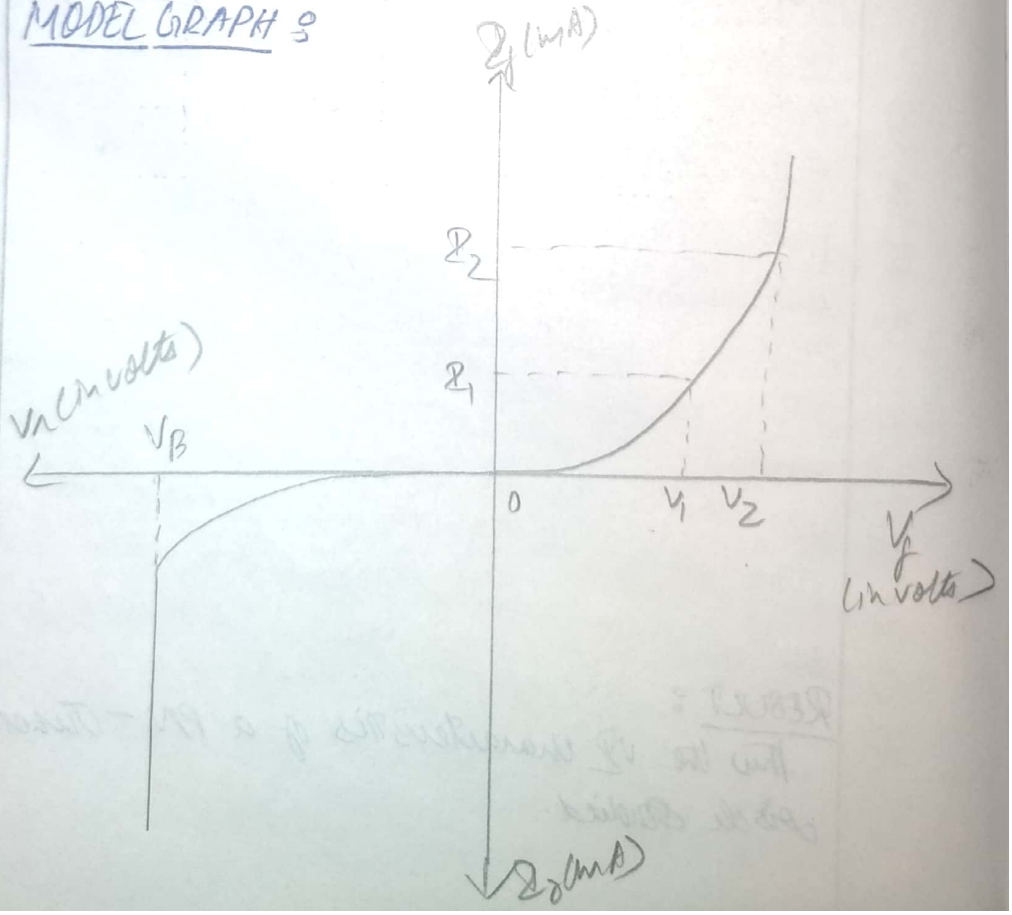
FORWARD BIAS:



REVERSE BIAS:



MODEL GRAPH:



Expt 06

CHARACTERISTICS OF ZENER DIODE

AIM:

To find the forward & reverse bias characteristics of a given zener diode.

Apparatus required:

S.NO	Name	Range	Qty
01)	R.P.S	(0-30) V	1
02)	Ammeter	(0-30) mA	2
03)	Voltmeter	(0-1) V	1
		(0-10) V	1

COMPARTMENT REQUIRED:

S.No	Name	Range	Qty
01)	Zener Diode	FZ5.1	1
02)	Resistor	1KΩ	1
03)	Bread Board	–	1
04)	Wire	–	Req

THEORY:

A property doped crystal diode, which has a sharp breakdown voltage, is called as Zener diode.

FORWARD BIAS:

Initially no current flows due to barrier potential. As the applied potential increases, it exceeds the barrier potential at one value and the charge carriers gain sufficient energy to cross the potential barrier & enter the other region. the holes, which are majority carriers in p-region, become minority carriers on entering N-region and electron which are the majority carriers in the N-region become minority carrier on entering the P-region.

TABULAR COLUMN:

FORWARD BIAS:

S.No	Voltage (in V) V_f	Current (in mA) I_f
01)	0.44	4.55
02)	0.49	9.5
03)	0.52	14.47
04)	0.54	19.45
05)	0.56	24.44
06)	0.57	29.43
07)	0.58	34.42
08)	059	39.41

REVERSE BIAS:

S.No	Voltage (in V) V_r	Current (in mA) I_r
01)	4.99	5.52
02)	5.99	4.41
03)	5.64	9.36
04)	5.67	14.33
05)	5.69	19.3
06)	5.7	24.3
07)	5.72	29.28
08)	5.73	34.27

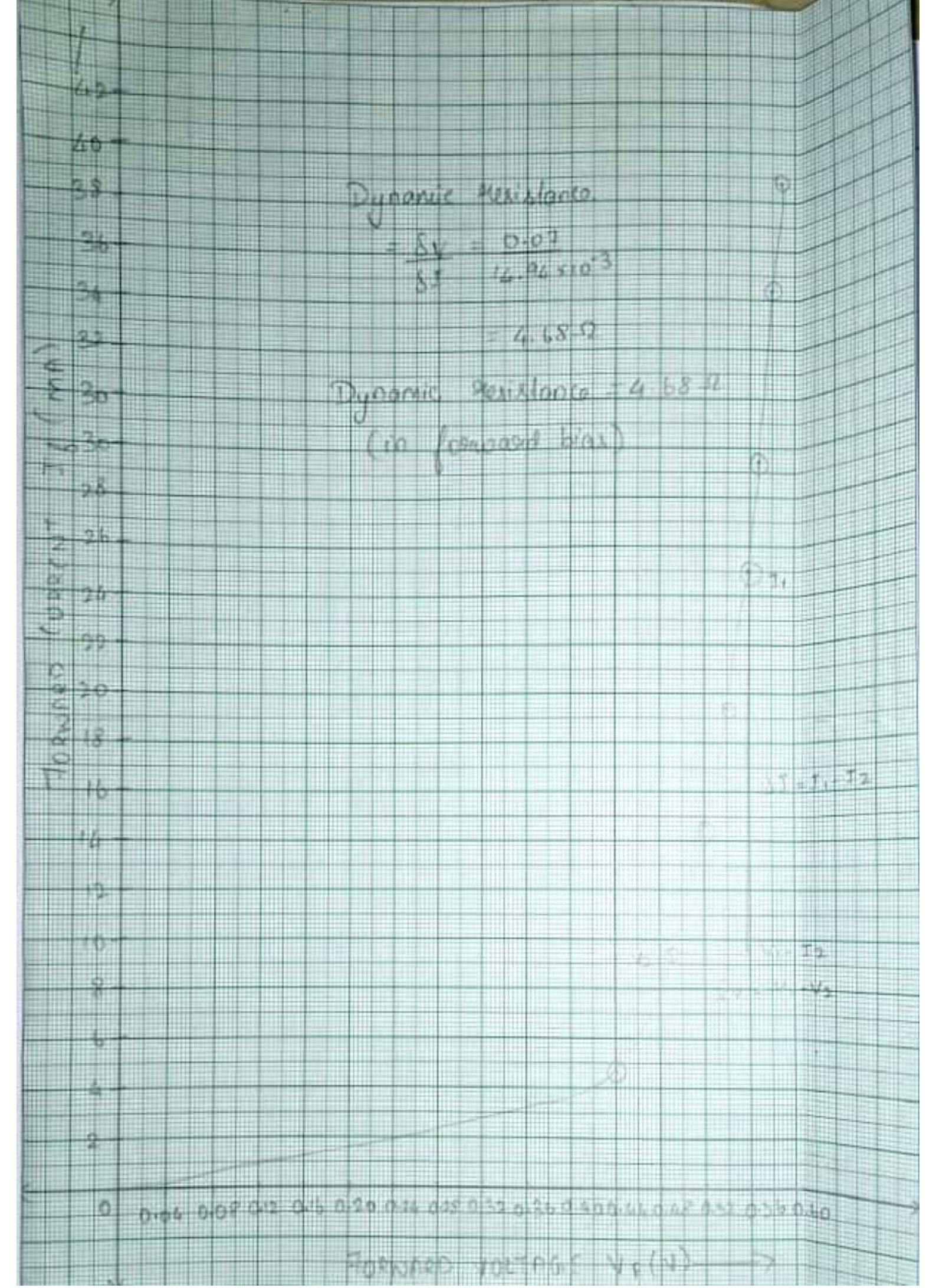
Dynamic Resistance

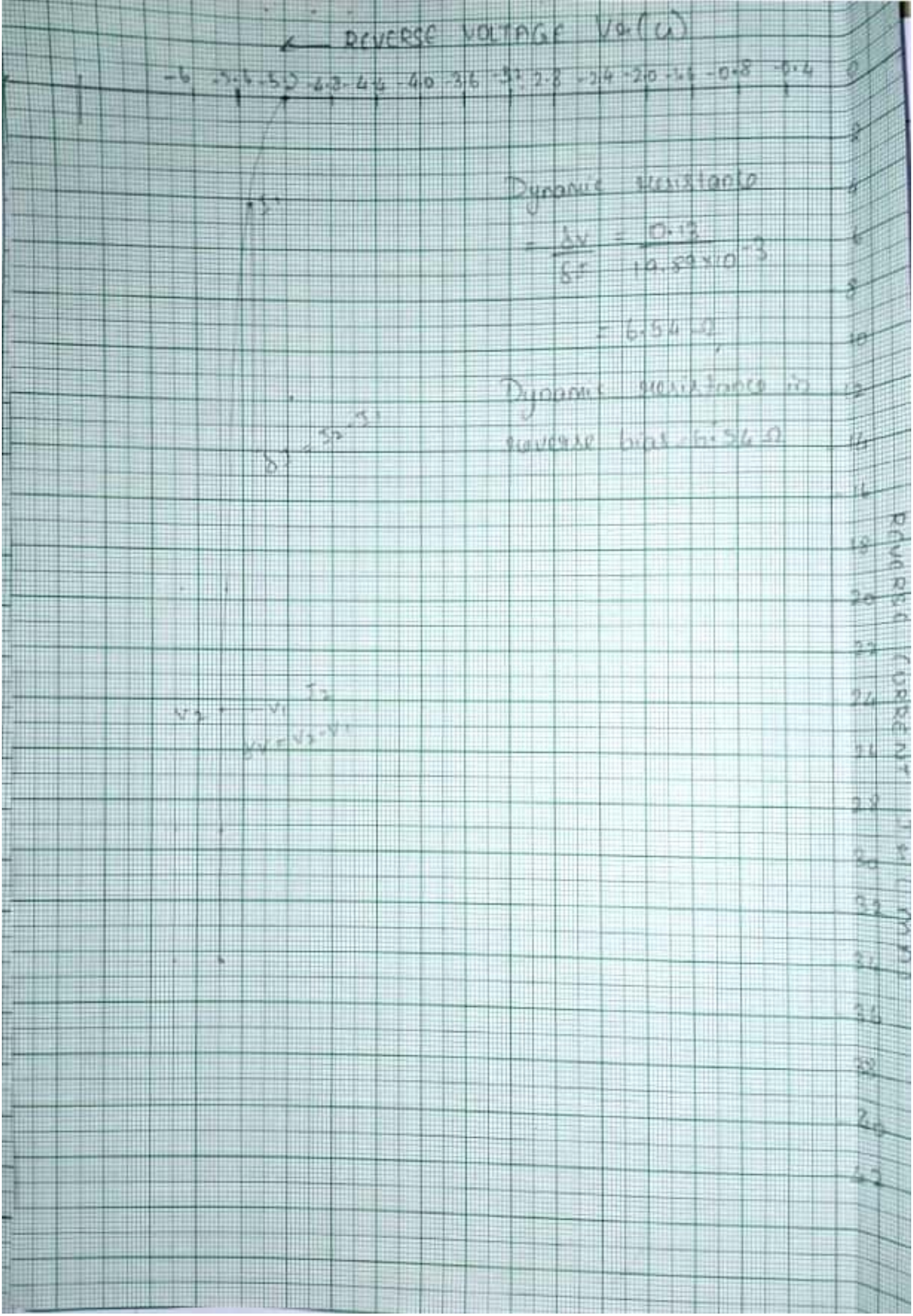
$$= \frac{\Delta V}{\Delta I} = \frac{0.07}{14.96 \times 10^{-3}}$$

$$= 4.68\ \Omega$$

Dynamic Resistance = 4.68 Ω

(in forward bias)





REVERSE BIAS:

When the reverse bias is applied, due to majority carriers small amount of current (i.e.,) reverse saturation current flows across the junction. As the reverse bias is increased to breakdown voltage, sudden rise in current takes place due to zener effect.

ZENER EFFECT:

Normally, PN junction of zener diode is heavily doped. Due to heavy doping the depletion layer will be narrow. When the reverse bias is increased the potential across the depletion layer is more. this exerts a force on the electrons in the outermost shell. Because of this force, the electrons are pulled away from the parent nucleus & become free electrons. This ionization, which occurs due to electrostatics force of attraction, is known as zener effect. It results in large number of free carriers, which in turn increases the reverse saturation current.

PROCEDURE:

FORWARD BIAS:

01) Connect the circuit as per the circuit diagram.
02) Vary the power supply in such a way that the reading are taken in steps of 0.1V in the voltmeter till the needle of power supply shows 30V.
03) Note down the corresponding ammeter reading.
04) Plot the graph between V & I.
05) Find the dynamic resistance $r = \delta V / \delta I$

REVERSE BIAS:

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02) Vary the power supply in such a way that the readings are taken in steps of 0.1 V in the voltmeter till the needle of power supply shows 30V.
03) Note down the corresponding ammeter reading I.
04) Plot a graph between V & I.
05) Find the dynamic resistance $r = \delta V / \delta I$
06) Find the reverse voltage V_z at $I_z = 20mA$.

RESULT:

The characteristics of zener diode is forward & reverse bias was studied & plotted (V-I characteristics)