Practical No.17: Determine the voltage regulation by using zener diode under variable input and output conditions.

I Practical Significance:

It is required to provide regulated power supply to various circuits and Integrated Circuits. Zener diodes have a primary application as a voltage regulator. Various electronic equipment's and circuits require regulated power supply which can be provided by Zener voltage regulator. Student should be able to test zener as a voltage regulator for variable input and variable load.

II Industry/Employer Expected Outcome(s):

Electrical and Electronic industries use different types of DC power supplies with different voltage and current ratings. Zener diode works as a voltage regulator in DC power supply. Depending on the input voltage and required output voltage zener diode should be selected.

III Course Level Learning Outcome(s):

Use relevant diode in different Electronic circuits.

IV Laboratory Learning Outcome(s):

Find the voltage regulation of zener diode.

V Relevant Affective Domain related outcome(s):

1. Carefully handling of components and circuits.
2. Visually aesthetic connections.

VI Relevant Theoretical Background (With diagrams if required):

Zener diode is designed to operate in the breakdown region. It is possible to construct Zener diode with required breakdown voltage in reverse bias condition. After breakdown, Zener diode acts as a constant voltage source i.e. if the applied reverse voltage exceeds the Zener voltage; it keeps the voltage across the device constant. Since it acts as a constant voltage regulator i.e. it keeps the output voltage constant irrespective of changes in load current or changes in input voltage.

IX Precautions to be followed:

1. Do not switch ON the power supply unless the circuit connection are checked as per the circuit diagram.
2. See the data sheet to know the reverse breakdown voltage of the given diode before Starting the experiment.
3. Connect Voltmeters/Ammeters in correct polarities as shown in the circuit diagram
4. Switch OFF the power supply after taking readings.

X Procedure:

1. Connect the circuit as per the circuit diagram.
2. Switch ON the power supply.

Load Regulation (Keep the Input voltage at 5V-10V)

1. By changing the Load Resistance R_L, measure the corresponding output (Voltmeter) voltage.

2. Measure the current in the two ammeters to measure zener current Iz and Load current I_L

Line Regulation

Keep the Load resistance R_L constant. Vary the input supply Vs & note down the corresponding output voltage.

Graph

Plot the graph of Load current I_L (X-axis) Versus Load voltage Vo (Y-axis). Plot a graph between Input voltage Vs (X-axis) Versus Output Voltage Vo (Y-axis)

XI Required Resources/apparatus/equipment with specifications:

S. No	Instruments/Components	Suggested broad specification	Quantity
1	digital multimeter	3 1/2 digit display	1
2	zener Diode	IN4735	1
3	DC Ammeter	0 - 200mA	01
4	Resistor	1kΩ	1

XII Actual procedure followed:

1. Connect the circuit as per the circuit diagram
2. Switch ON the power supply.
3. plot the graph between output voltage and input voltage.

XIII Observations and Calculations:

a. Load Regulation

Input Voltage V_S = ———

Table: 1

Sr. No	I_Z(mA)	I_L(mA)	V_O(V)
1	0	34.0	6
2	0	23.1	6
3	0	17.7	6
4	0	13.2	6
5	0	10.6	6
6	0.0369	8.96	5.10
7	1.21	7.79	5.10
8	2.22	6.78	5.10
9	3.12	5.88	5.10
10	3.69	5.31	5.10
11	4.06	4.94	5.10

Calculation: No Load Voltage V_{NL}- Output voltage across R_L when Load current is minimum. Full load Voltage V_{FL}- Output voltage across R_L when Load current is maximum.

b. Line Regulation

let 2

Sr. No	V_S(V)	I_Z (mA)	I_L (mA)	V_o(V)
1	0	0	2.74	0
2	2.4	0	2.74	2.4
3	5.4	-2.555	2.74	5.20
4	7.8	-0.373	2.74	5.20
5	11.6	3.081	2.74	5.20
6	14.2	5.445	2.74	5.20
7	16.6	7.627	2.74	5.20
8	19.6	10.354	2.74	5.20
9	22	12.536	2.74	5.20
10	25.4	15.627	2.74	5.20
11	29.4	19.263	2.74	5.20

Calculations:

i. Load Regulation $= \frac{V_{NL}-V_{FL}}{V_{FL}} \times 100$ (From Table: 1)

ii. Line Regulation $= \frac{\Delta V_o}{\Delta V_S} \times 100$ (From Table: 2)

XIV Results:

1. Zener breakdown voltage = 25.....
2. Forward resistance of zener diode = ..10...Ω

XV Interpretation of Results:

we learn to determine the voltage regulation by using zener diode under variable input and output conditions.

XVI Conclusions & Recommendations:

we have learn to determine the voltage regulation by using zener diode under variable input and output conditions.

XVII Practical Related Questions:

1. Give the value of input voltage when Zener current starts increasing?
2. For what value of Load resistance the Load current is Minimum?
3. For what value of Load resistance the Load current is Maximum?
4. Define zener breakdown?

[Space for Answers]

0.1 - - - ?

→ 0.0369

Q.2. - - - - ?

→ the load current (IL) is minimum when the load resistance (RL) is maximum as per ohm's law (IL = V/RL).

Q.3. - - - - ?

→ the load current (IL) is maximum when the load resistance (RL) is minimum, approaching zero (short circuit condition).

Q.4 - - - - ?

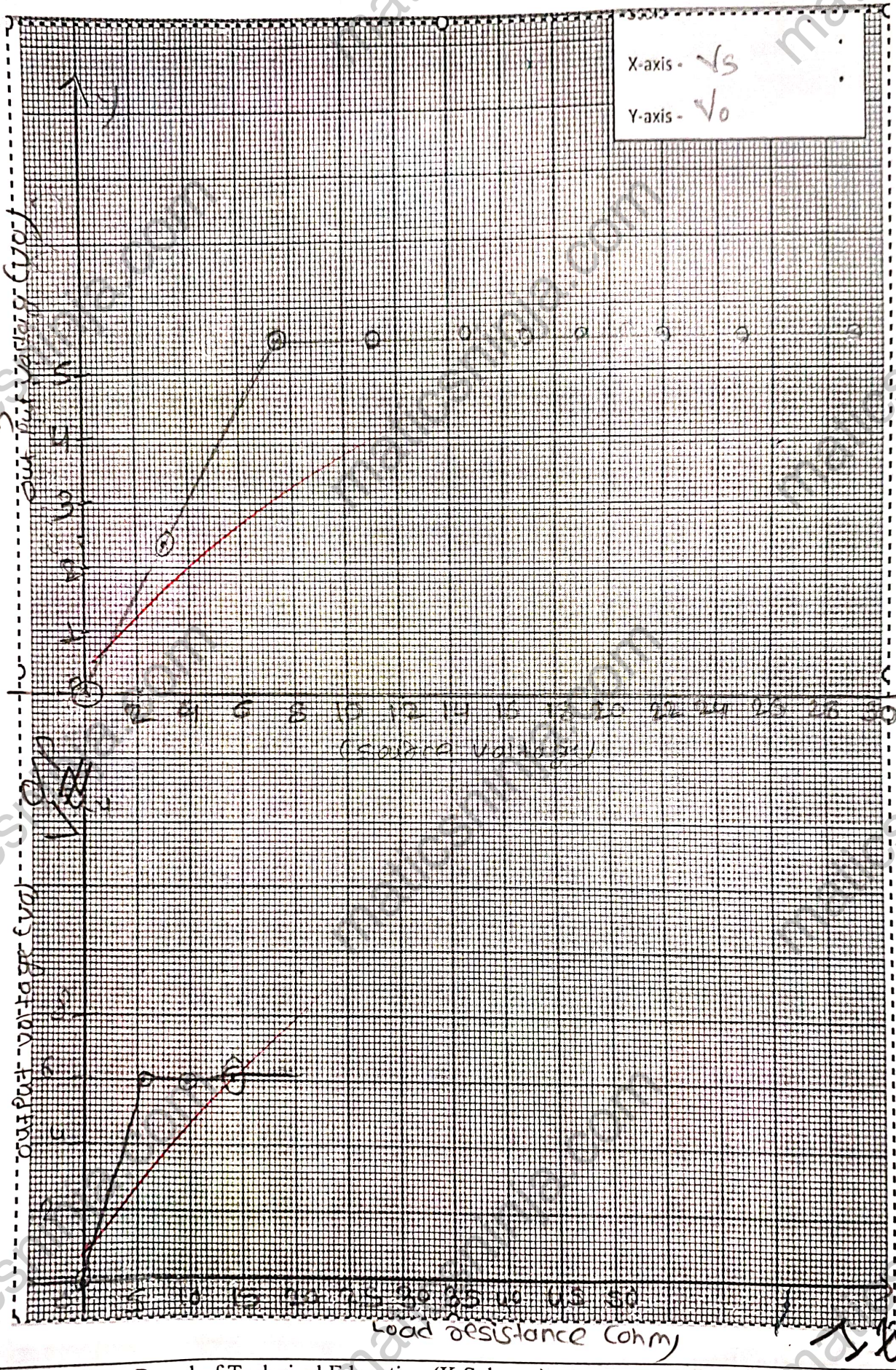
→ zener breakdown occurs when the reverse voltage across (VZ) causing a sharp increase in reverse current while maintaining a nearly constant voltage.

XVIII References/ suggestions for further reading ; includes websites:

https://www.youtube.com/watch?v=itzPT3UbC1I

S.No.	Title of Book/Website	Author	Publication
1	Applied Electronics	R.S.Sedha	S.Chand and Co.,New Delhi 2008,ISBN 978-8121927833
2	Principles of Electronics	V.K.Mehta	S.Chand and Co.,Ram Nagar,New Delhi-110055,11th Edition,2014,ISBN 978-812-192405

graph for line regulation



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