

Experiment 5

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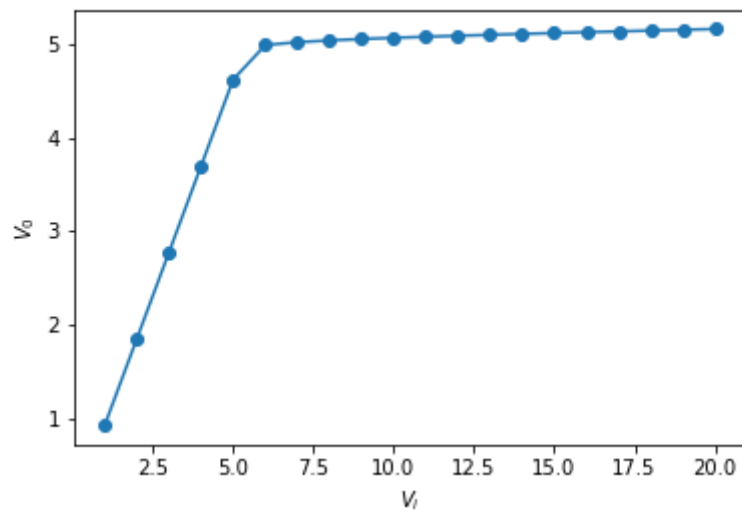
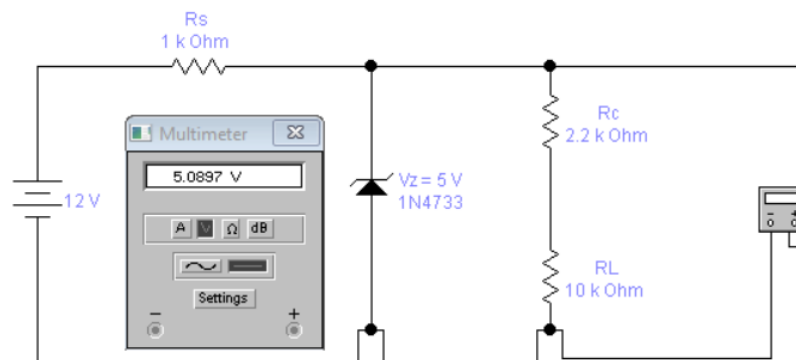
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Aim

- To study the Zener diode as a voltage regulator with the help of line and load regulations.
- To understand some of the Zener diode application circuits.

Results

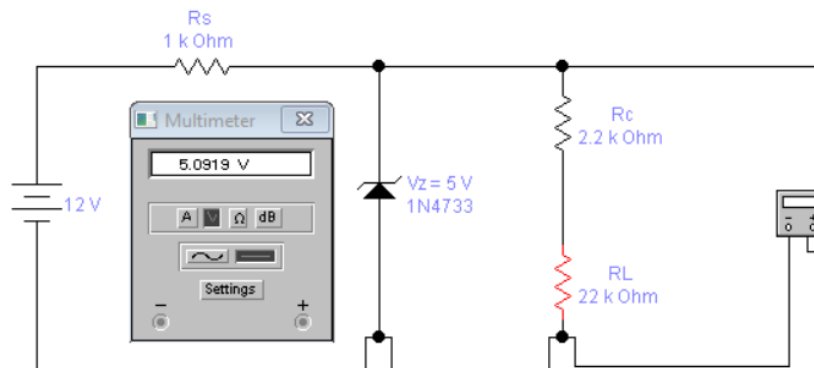
Line regulation



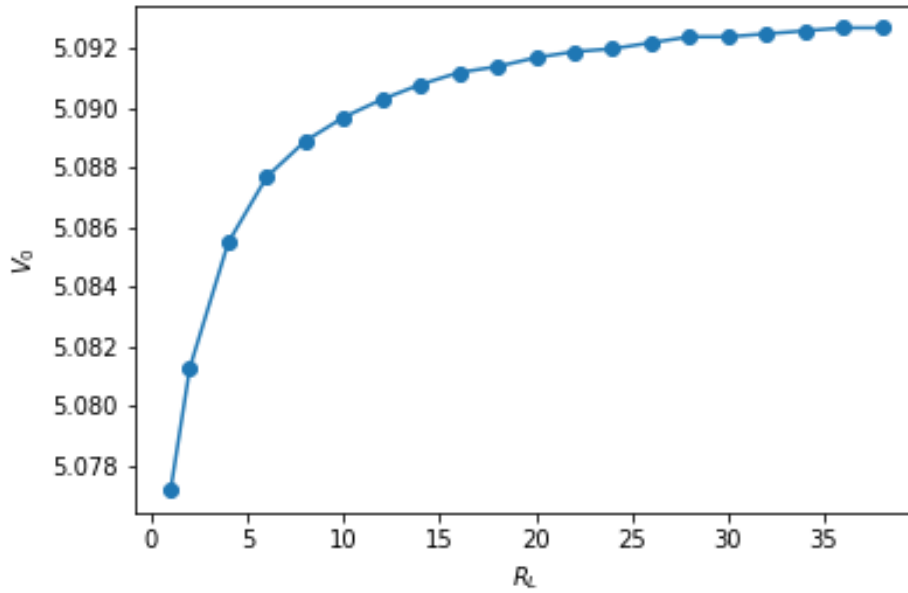
R_L (k Ω)	V_i (volts)	V_o (volts)
10	1	0.9242
10	2	1.8485
10	3	2.7727
10	4	3.697
10	5	4.6212
10	6	4.9901
10	7	5.0211
10	8	5.04
10	9	5.0548
10	10	5.0676
10	11	5.0791
10	12	5.0897
10	13	5.0998
10	14	5.1094
10	15	5.1187
10	16	5.1277
10	17	5.1364
10	18	5.145
10	19	5.1534
10	20	5.1616

For line regulation, only input voltage is varied and the curve starts flattening at **5.1 V**. Therefore, breakdown voltage of the **1N4733 Zener diode** is **5.1V**.

Load regulation

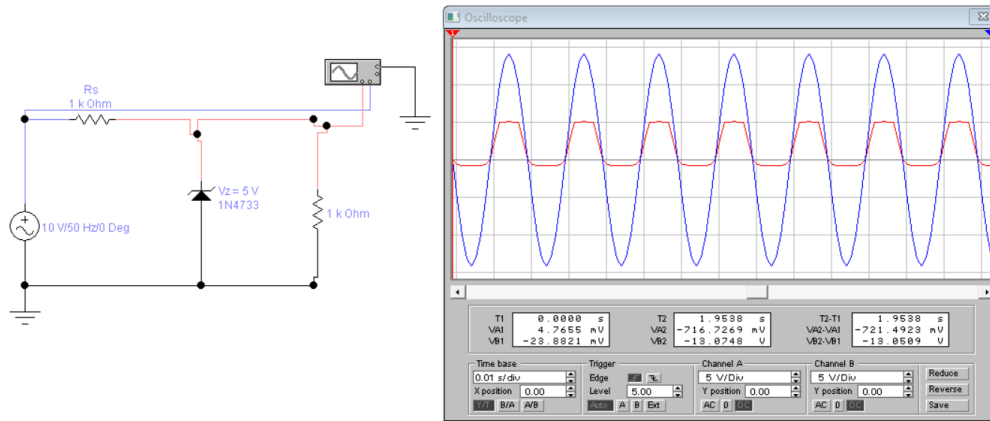


R_L (k Ω)	V_i (volts)	V_o (volts)
1	12	5.0772
2	12	5.0813
4	12	5.0855
6	12	5.0877
8	12	5.0889
10	12	5.0897
12	12	5.0903
14	12	5.0908
16	12	5.0912
18	12	5.0914
20	12	5.0917
22	12	5.0919
24	12	5.092
26	12	5.0922
28	12	5.0924
30	12	5.0924
32	12	5.0925
34	12	5.0926
36	12	5.0927
38	12	5.0927



For load regulation, the load resistance is varied. The curve flattens around **5.0927 V**. Therefore, the breakdown of the **1N4733 Zener** diode is around 5.1V.

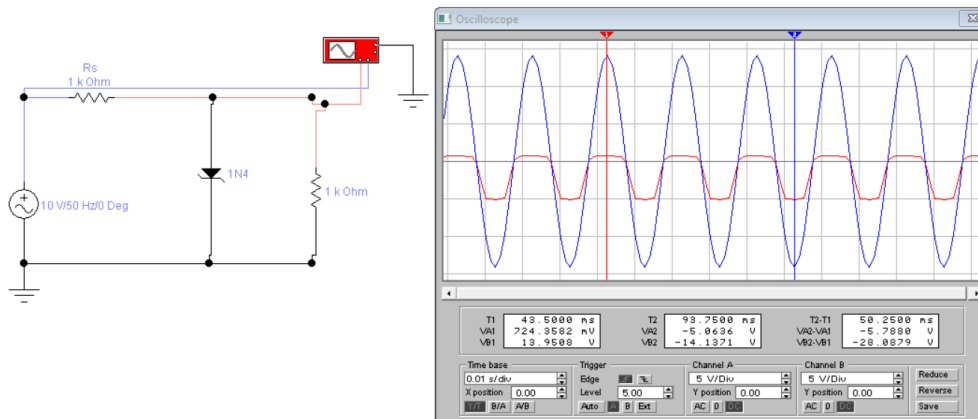
Wave-shaping Zener - Postive clipper



The shape of the waveform is modified from a sine wave to a square wave. The input RMS voltage is 10V. In the positive half cycle, the zener diode is reverse biased and therefore the waveform gets clipped at the breakdown voltage of 5.1 V, the output is flat.

During the negative half cycle, the zener diode acts like a normal forward biased diode with its 0.7 V junction voltage. Therefore, there is a small AC output in the negative region. Peak to Peak is 5.787 V.

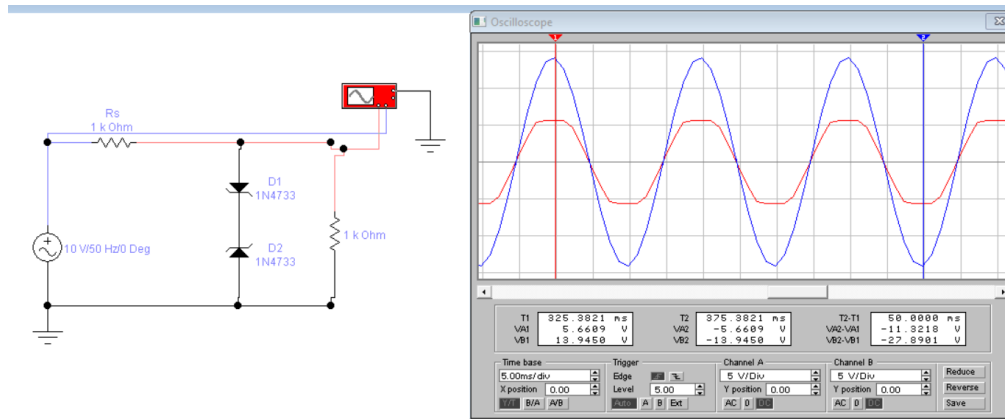
Wave-shaping Zenner - Negative clipper



Here too, the shape of the waveform is modified from a sine wave to a square wave. This time in the negative half cycle, the zener diode is reverse biased and therefore the waveform gets clipped at the breakdown voltage of 5.1 V on the negative side and ends up being flat.

During the positive half cycle, the zener diode acts like a normal forward biased diode with its 0.7 V junction voltage. Therefore, there is a small AC output in the positive region. Peak to Peak is 5.788 V.

Wave-shaping zener - Full Wave clipper



voltage is 5.7896V which is the sum of Zener breakdown voltage and the junction potential. 3. Zener wave shaper II (Full-wave clipper) This circuit clips both the positive and negative part of the input waveform and gives a square wave output. This is a combination of the previous two circuits. In both the positive and negative half cycles, if the input is below the Zener breakdown, voltage resistance offered by both the diodes is very high because of which we see a slant line moving gradually toward the peak. And when input is greater than or equal to the Zener breakdown voltage, we get a flat output equal to the Zener breakdown voltage. The final output is nearly a square wave with a peak at a combination of zener breakdown voltage and the junction potential of the diode. The peak to peak is at 11.3218.