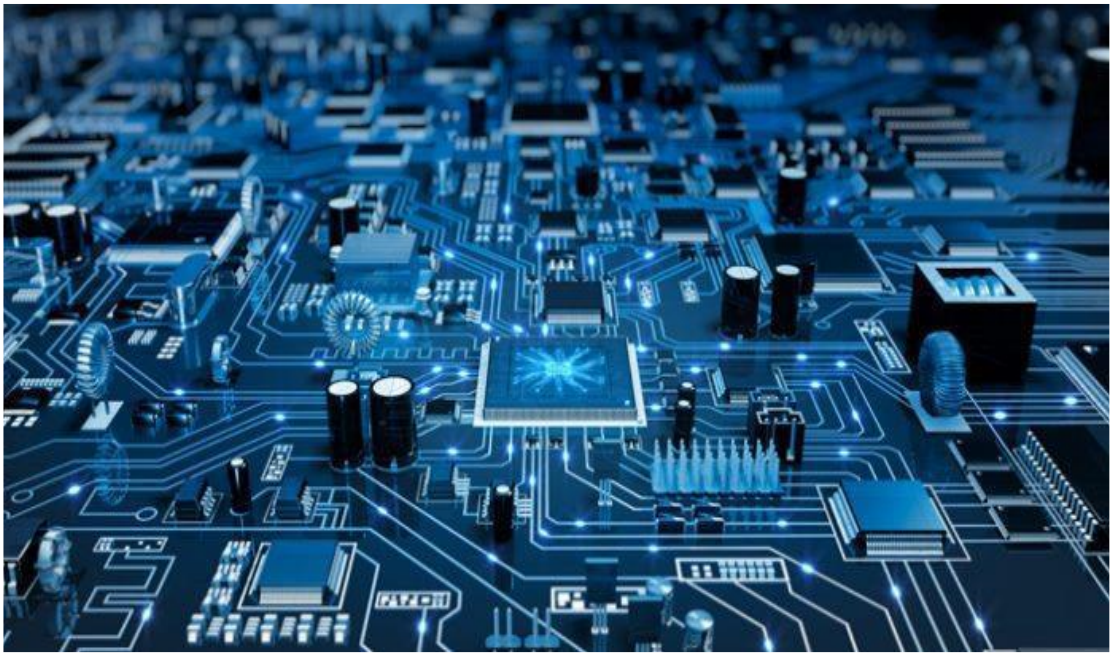
Al-Mustaqbal University
Department of Medical Instrumentation Techniques Engineering
Class: Third
Subject: Medical Communication Systems
Lecturer: Prof. Adnan Ali
Lecture:5

## Mode Unit 5

# Zener with AC Circuits (Clippers)

For
Students of Third Stage
Department of Medical Instrumentation Techniques Engineering



**By**

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Techniques Engineering

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# 1. Overview

## a. Target population:

For students of third class of Department of Medical Instrumentation Techniques Engineering, Electrical Engineering Technical College, Middle Technical University, Baghdad, Iraq.

## b. Rationale:

The clipping of the input signal produces an output waveform that resembles a flattened version of the input. For example, the half-wave rectifier is a clipper circuit, since all voltages below zero are eliminated.

## c. Objectives:

The student will be able after finishing lecture on:

- Draw the waveform of Zener as clippers in AC circuits.
- Identify the main components of clipper circuits.

## 2. Introduction:

Zener diode based clipping circuits limit the certain part of the input waveform that is applied across the input terminals, these Zener diode clippers are generally used for protecting the circuits and in shaping of the input waveforms. Consider a clipper circuit as shown in the figure. If we want to clip the waveform above 3.2 V, we will use a 3.2 V Zener diode.

The output waveform can be clipped on the positive side by greater than 3.2 V and there maintains a constant output. The waveform on the negative side is clipped at 0.7 V and there after the Zener diode turns ON and acts as a silicon diode.

The diode and power supply as shown will prevent the output voltage from exceeding 0.7V. Zener diode clipping circuits are used to eliminate noise in amplitude and spikes in voltage, voltage regulation and to make fresh waveforms from an existing signal such as squaring off the peaks of a sinusoidal waveform to obtain a rectangular waveform.

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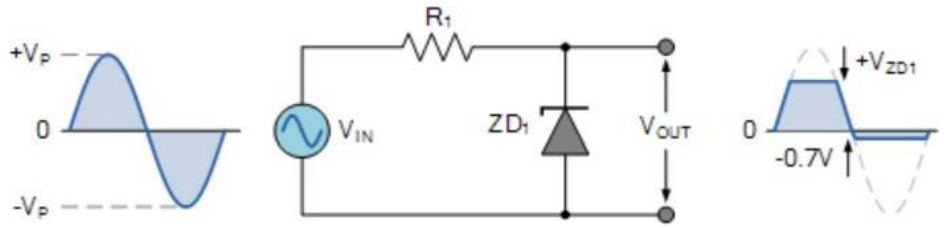
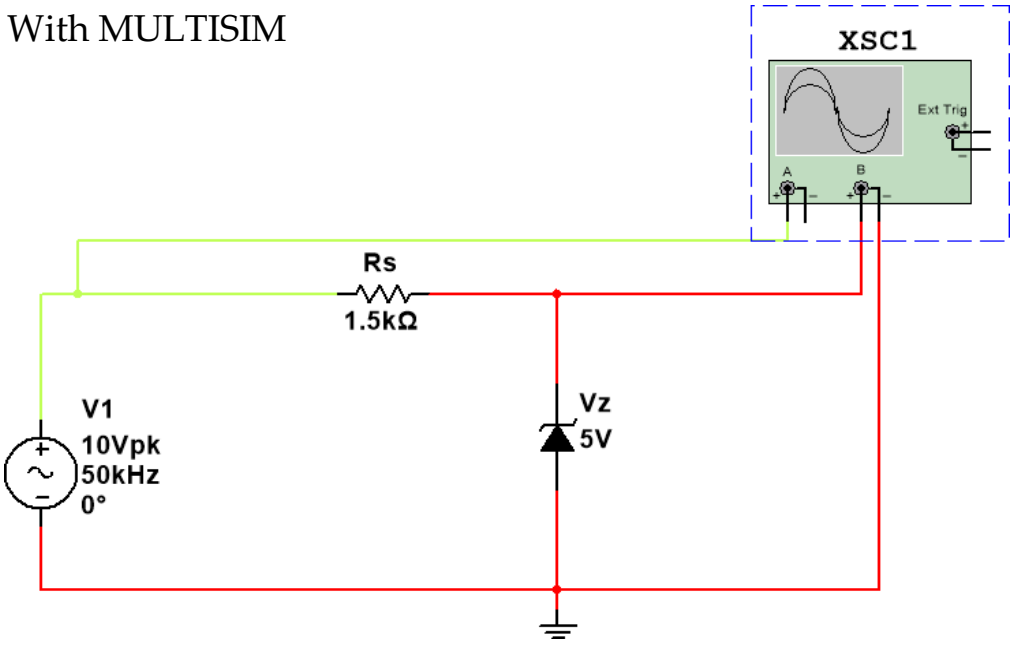
As we know, the Zener diode is a another type of diode that has been specially manufactured to operate in its reverse biased breakdown region and as such can be used for voltage regulation or Zener diode clipping applications. In the forward region, the Zener acts just like an ordinary silicon diode with a forward voltage drop of 0.7V (700mV) when conducting, the same as above.

However, in the reverse bias region, the voltage is blocked until the Zener diodes breakdown voltage is reached. At this point, the reverse current through the Zener increases sharply but the Zener voltage, VZ across the device remains constant even if the Zener current, IZ varies. Then we can put this Zener action to good effect by using them for clipping a waveform as shown.

## Positive Zener Clipping Circuits




With MULTISIM



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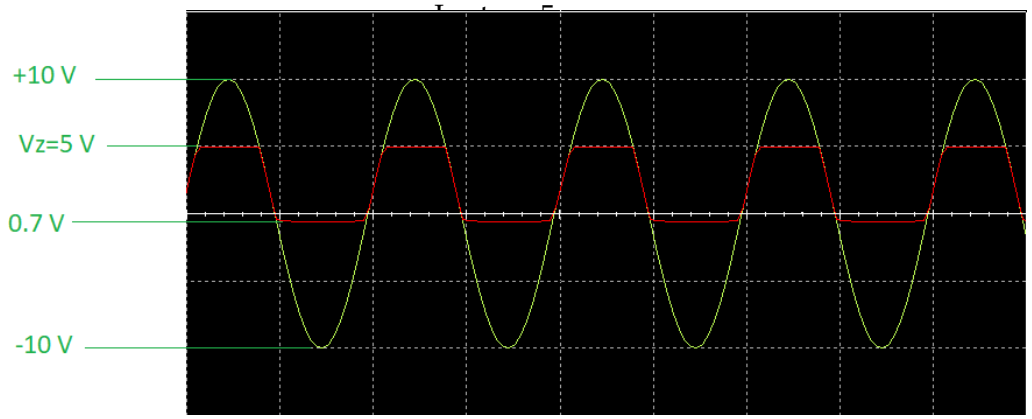
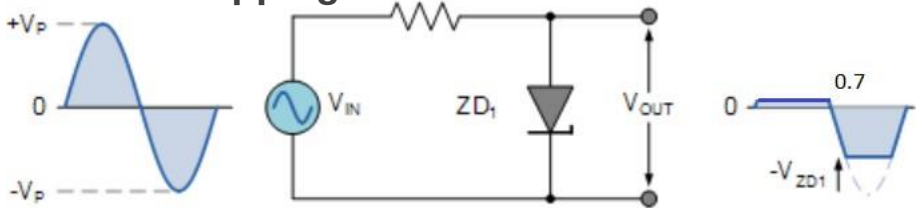



## Negative Zener Clipping Circuits

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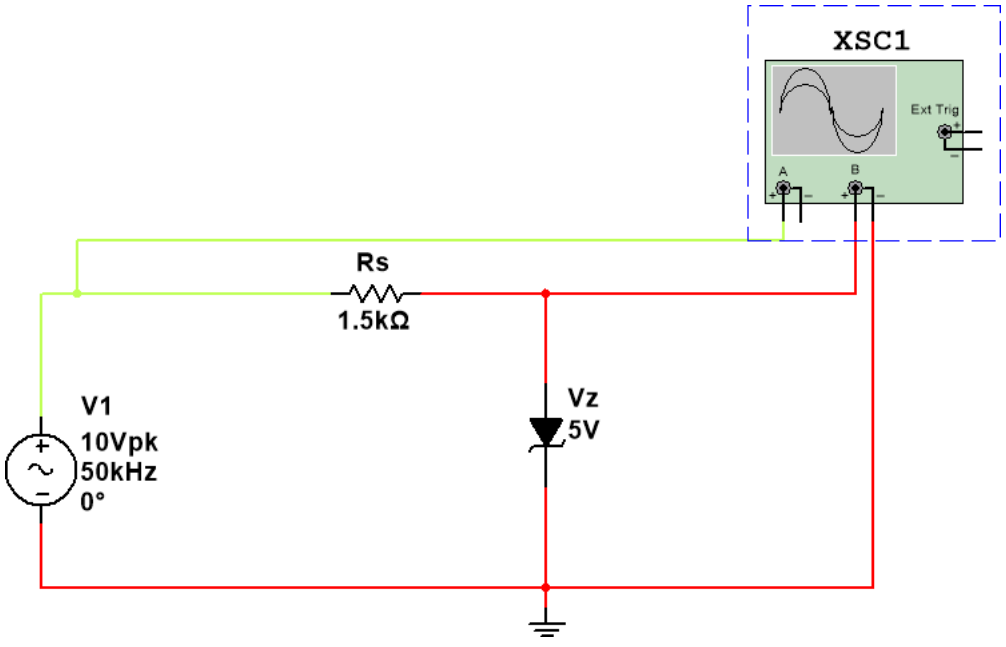

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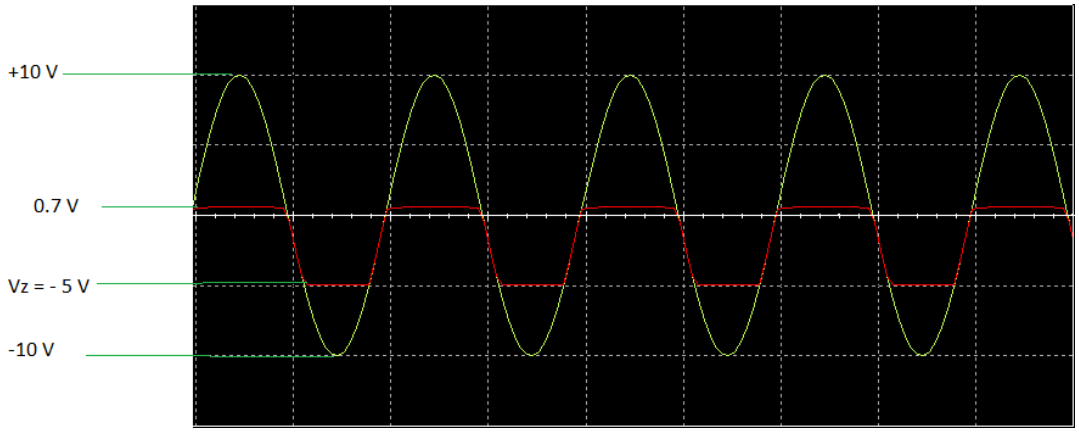
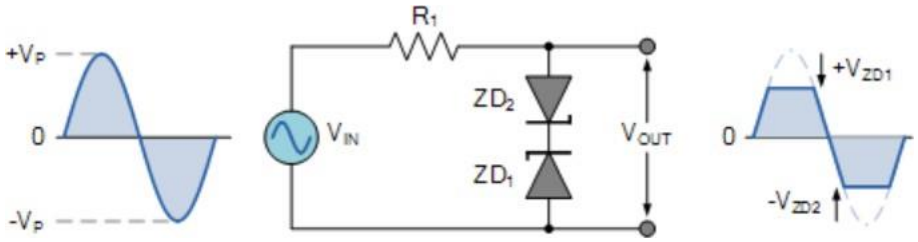
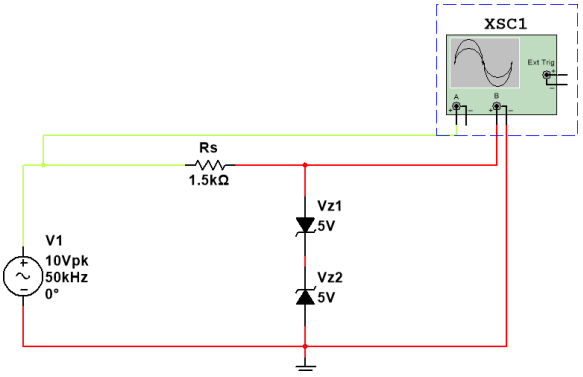



## Full-wave Zener Diode Clipping




Connecting the Zener diodes in opposite direction, back-to-back fashion produces an AC regulator that can be used as a square wave generator. It is the most commonly used Zener diode connection for clipping the waveforms and protecting the electronic circuits from over voltage. Both the Zener diodes are usually connected across the input terminals of the power supply, at some point in the normal functioning, one of the Zener diodes in the circuit is OFF and the other Zener diode have no or very little affect.

With MULTISIM



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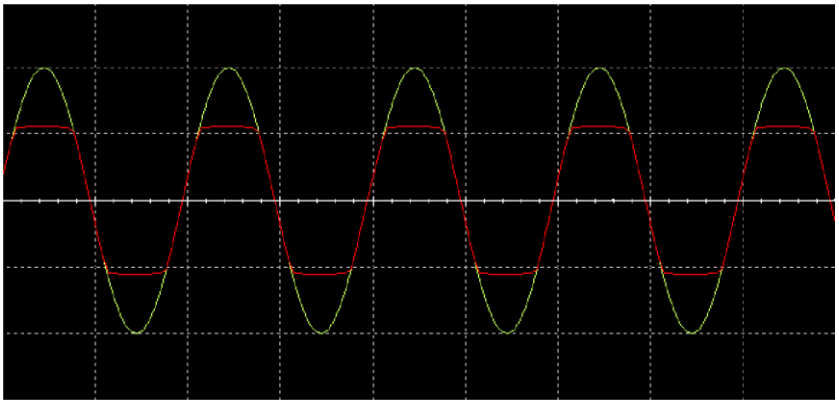
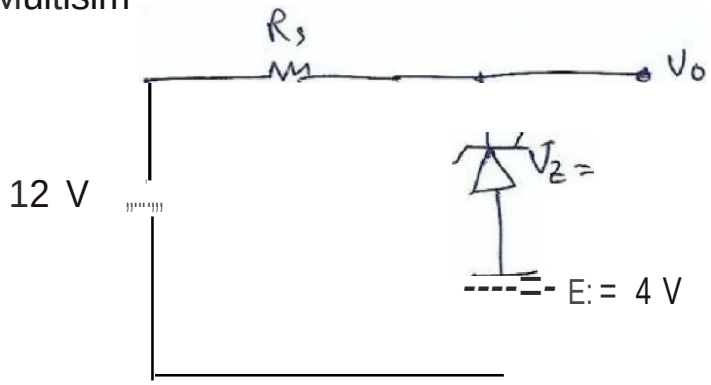


**H.W:** For the following circuit draw Vo and V Rs using Multisim




**Ex:** Draw $V_0$