

Lab 2. Signal Generation and Analyses

Overview of this Session

In this laboratory, you will learn:

- How to use a function generator to create square, triangular and sine waves.
- How to use an oscilloscope to measure characteristics of unknown signals.
- Study diode characteristics
- How to use a Light Emitting Diode (LED)
- How to rectify an AC signal using a diode (convert AC to DC)

Introduction

The TA will show you how to use the signal/function generator and the oscilloscope. The TA will show you (on the oscilloscope) a 1 kHz sine wave with a peak-to-peak amplitude of 2 volts with DC offset of 0 volts and then the same waveform with a DC offset of +3 volts.

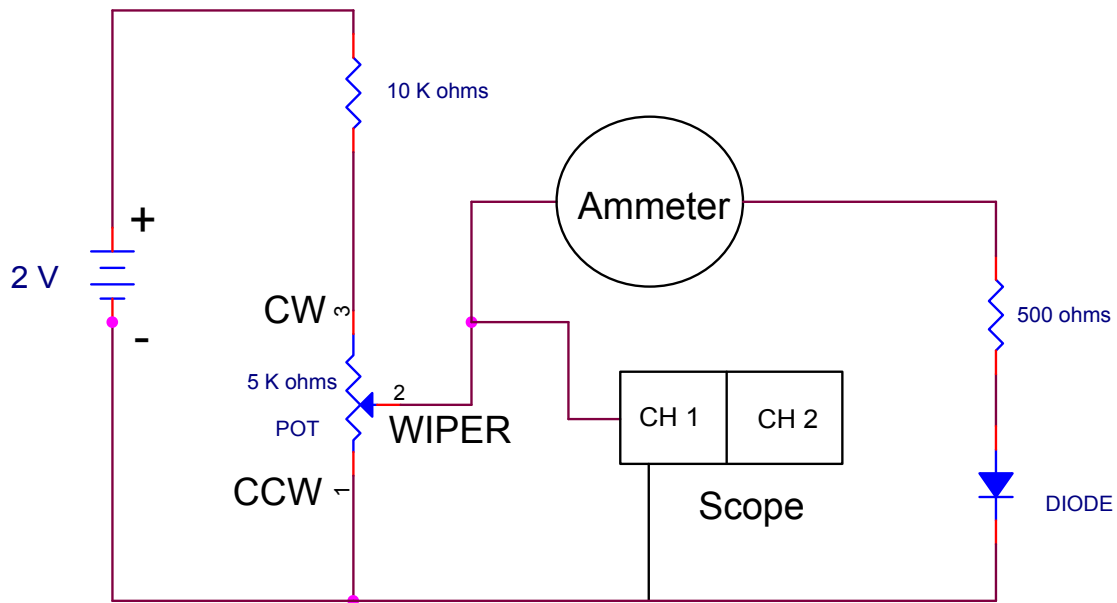
Signal Generation and Measurements

- 2.1 Connect the output of the signal generator to one of the channels of the oscilloscope using a BNC cable.
- 2.2 Generate a 5 kHz square wave with 4 volts peak-to-peak amplitude with zero DC offset. Write down explicitly how you calculated the frequency and amplitude of the waveform using the oscilloscope. Is the frequency measured using the oscilloscope same as that displayed on the function generator panel?
- 2.3 DC offset the above wave by -2 volts. Draw the waveforms (with and without DC offset) as they appear on the oscilloscope. Show the waveforms to the TA.

Diode DC Characteristics

- 2.4 Unlike resistors, diodes allow current to flow only in one direction. To identify the direction of current flow, measure the resistance of the given diode using the multimeter in both directions. Mark the terminals as + and - (the current flow direction is from + to -). The diode is said to be forward biased when current flows through it.

2.5 To determine the current (I)/voltage (V) characteristics of a diode, you have to make a voltage divider circuit as shown below. In the forward bias regime, apply +2 using the power supply. Confirm the supply voltage by connecting the multimeter directly across the power supply. Then use the potentiometer to apply voltage across the given diode/resistor network in increments of 0.1 volts starting from 0 volts until you find the current flowing through the diode starts increasing exponentially. Do not exceed the voltage beyond this point. Monitor the applied voltage by connecting the oscilloscope directly across the potentiometer wiper and ground terminal. At every applied voltage increment, measure the current flowing through the diode by using the multimeter as an ammeter. Plot the I-V curve.



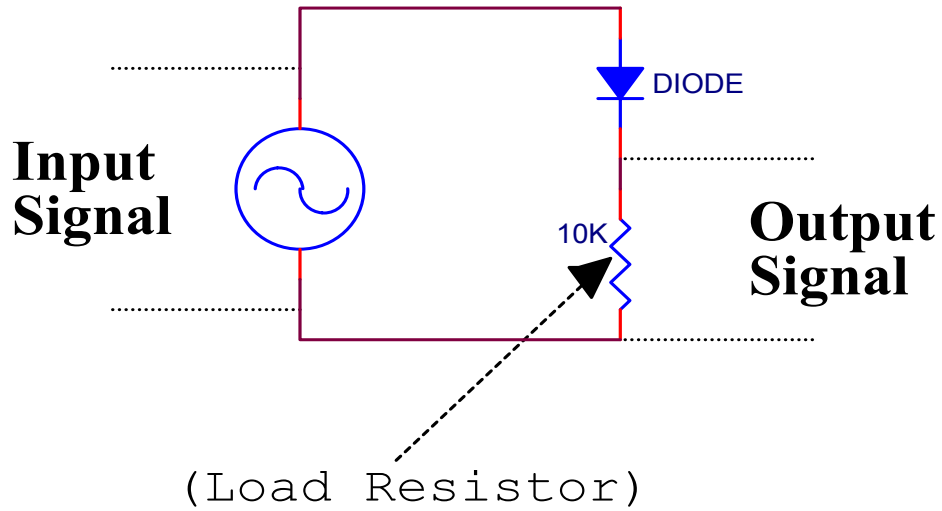
CIRCUIT TO DETERMINE I/V RESPONSE OF A DIODE

Light emitting Diodes (LEDs)

2.6 Replace the above diode with the given LED. Determine the forward bias voltage at which the diode starts emitting light.

Diode as a Rectifier (AC Characteristics)

2.7 Diodes are commonly used for converting an AC signal to a DC signal (rectification). Build the circuit below. Use a 1 kHz signal at the input with a peak-to-peak amplitude of 2 volts and zero DC offset. Using the oscilloscope, find the shape of the waveforms at the input signal and across the output load resistor, the rectified wave. Draw the waveforms, input and output, as observed on the oscilloscope.



Lab 2 Signal Generation and Analyses Answer Sheet

Name: _____ Section Number: _____
TAinit: _____ Date: _____

2.2 How was frequency calculated? How was the amplitude found? Were the results the same as displayed on the function generator panel? Show all your calculations.

2.3 Sketch of waveforms with and without DC offset of -2 volts:

2.5 Sketch the I-V curve for a diode

2.6 At what voltage does the LED start to emit light?

2.7 Sketch rectified waveforms. Label all the important points.