Trinity College Dublin
Coláiste na Tríonóide, Baile Átha Cliath
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Electro technology Lab Report

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STUDENT NUMBER: *16323766*

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LAB SESSION: *SESSION 2 (4 – 6PM)*

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MODULE: *CS 1025*

OBJECTIVE

Observe the output graphs of a circuit consisting of a resistor, a.c current and capacitor. Note the difference between a circuit in high pass and low pass. Observe the graph on the oscilloscope.

INTRODUCTION

Electronic circuits often have currents of different frequencies corresponding to voltages of different frequencies because a source produces current with the same frequency as the applied voltage. For example the a.c signal applied to an audio circuit can have high and low frequencies. The rectifier in a power supply produces d.c output with an a.c. ripple superimposed on the average d.c level. In such applications where the current have different frequency components, it is necessary to favor or reject one frequency.

An electrical filter is used to separate higher or lower frequencies. In many applications the circuit pulsating dc voltage, but only the ac component is desired. Then the ac component can be passed to the load, while the steady dc component is blocked by capacitive coupling. A capacitor has the ability to isolate or block a steady dc voltage

An active filter uses operational amplifier on an IC chip. The purpose is to eliminate the need for inductance. This feature is important in the filters for audio frequencies where large coils would be necessary.

APPARATUS

1. 2.2KΩ resistor
2. A.C current source
3. Breadboard
4. Oscilloscope
5. 22 nF capacitor

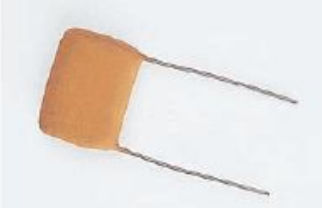
BACKGROUND INFORMATION

CAPACITANCE

Capacitance is the ability of a dielectric (*insulator*) to hold or store an electric charge. The higher the charge the higher the capacitance. The symbol for capacitance is *C,* and the unit measurement is the farad (F),

CAPACITOR

A capacitor consists of an insulator (*dielectric)* between two conductors. The conductors make it possible to apply voltage across the insulator. One of the main functions of a capacitor is to block a steady dc voltage while passing ac signals. The higher the frequency, the less the opposition to ac voltage.

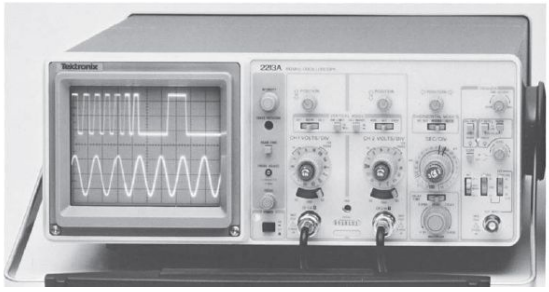


METHOD

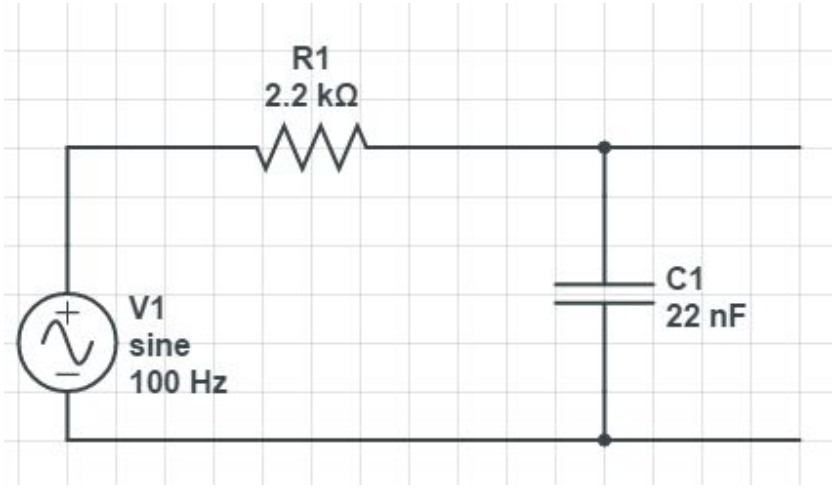
HOW TO USE AN OSSILOSCOPE

Oscilloscopes have the ability to measure the time, frequency, and voltage level of a signal, view rapidly changing waveforms, and determine if an output signal is distorted. An analog oscilloscope displays the instantaneous amplitude of an AC voltage waveform versus time on the screen of a cathode-ray tube (CRT). The oscilloscope is a graph-displaying device. The vertical axis (Y) represents voltage and the horizontal axis (X) represents time. Inside the cathode-ray tube is an electron gun assembly, vertical and horizontal deflection plates, and a phosphorous screen. The electron gun emits a high-velocity beam of electrons that strike the chemical coating on the inside face of the CRT, causing it to emit light. The intensity of light can be varied by a control located on the oscilloscope front panel. In general, an oscilloscope is normally used to make two basic measurements; amplitude and time. Oscilloscope probes (*LOW-CAPACITANCE PROBE (LCP) & DIRECT PROBE)* are the test leads used for connecting the vertical

input signal to the oscilloscope. Before starting an experiment with the oscilloscope we must ensure that it is calibrated correctly to ensure we get accurate results.

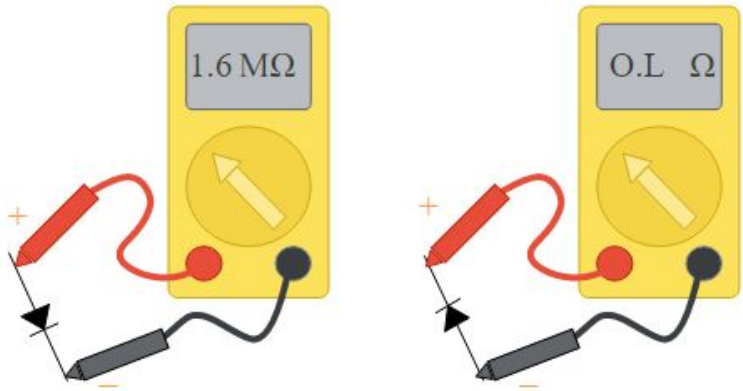


Circuit 1



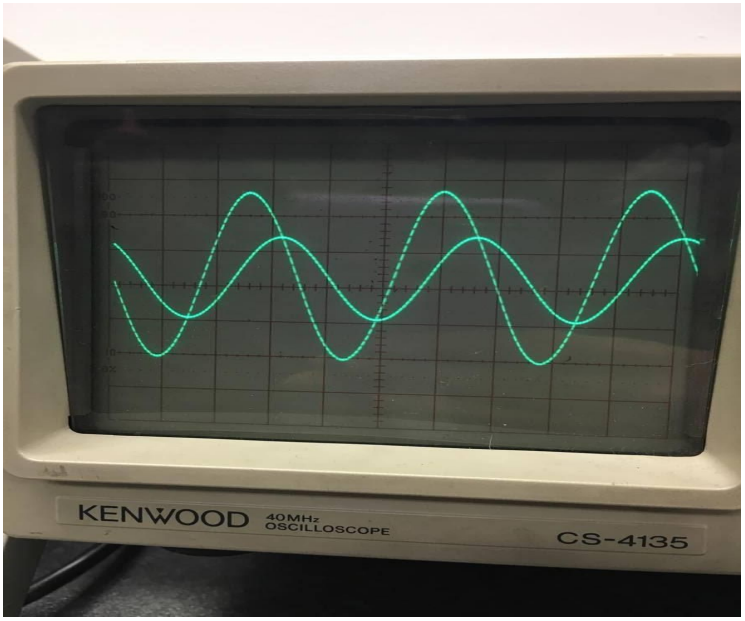
1. Before beginning the experiment we had to verify the identity of the terminals of the diode using the ohm-meter. We needed this to figure out the forward current direction. On the resistance setting, the meter puts a small voltage on its test leads. You use that small voltage to see which way current flows. If the ohm-meter reads a finite resistance, that means the diode is conducting a small current in the forward direction, and the red ++plus lead from the meter is

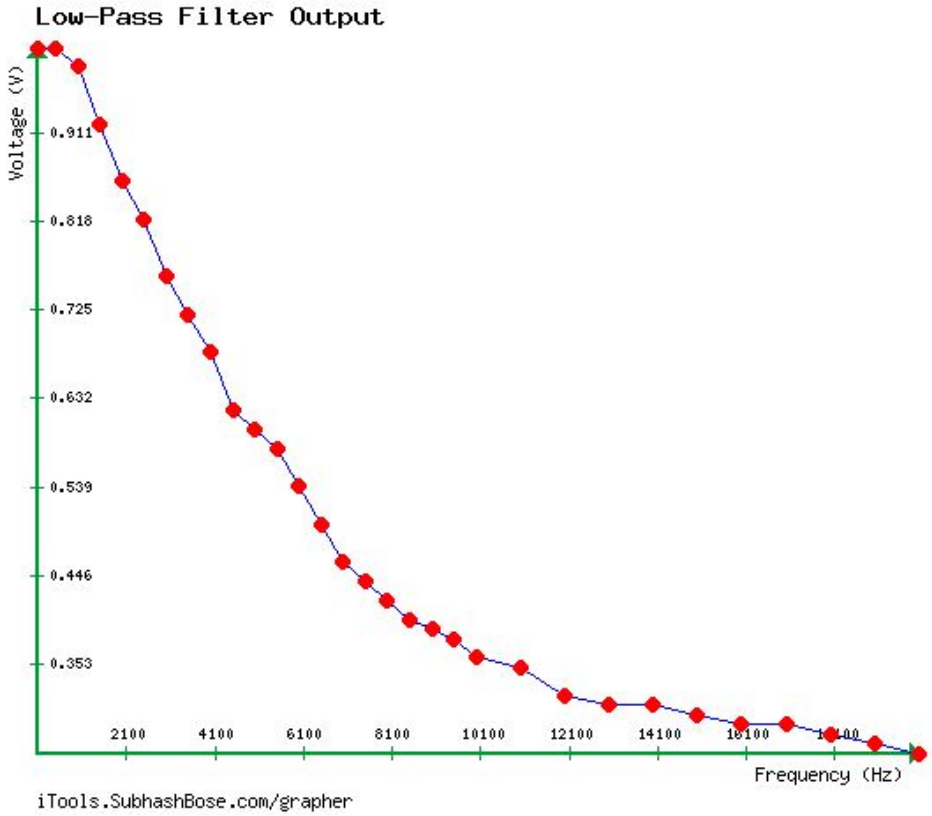
touching the anode. If the resistance reads O.L (for overload), the diode is not conducting current. That means the red ++plus test lead is touching the cathode.



2. Place the sinusoidal waveform voltage source, the resistor and the capacitor in the breadboard.
3. Connect the capacitor and resistor in parallel.
4. Connect the function generator to the resistor and channel 1 of oscilloscope to the circuit output.
5. Connect function generator, oscilloscope ground terminal to the common ground of the breadboard.
6. Set the frequency and amplitude of the input signal.
7. Note the voltage for every 500Hz
8. Plot the Low-Pass Filter graph

INPUT/SUPERIMPOSED GRAPH OF LOW-PASS

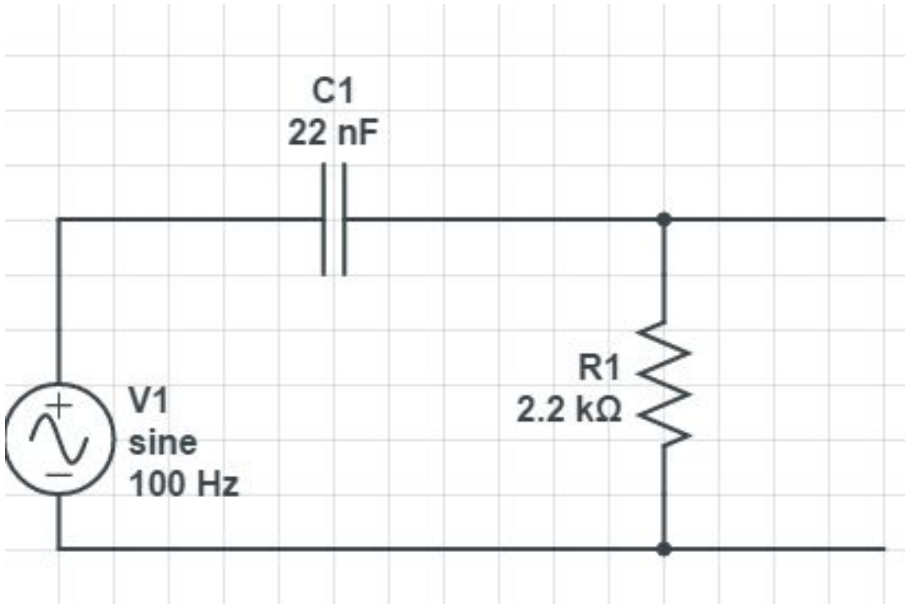




ANALYSIS OF GRAPHS

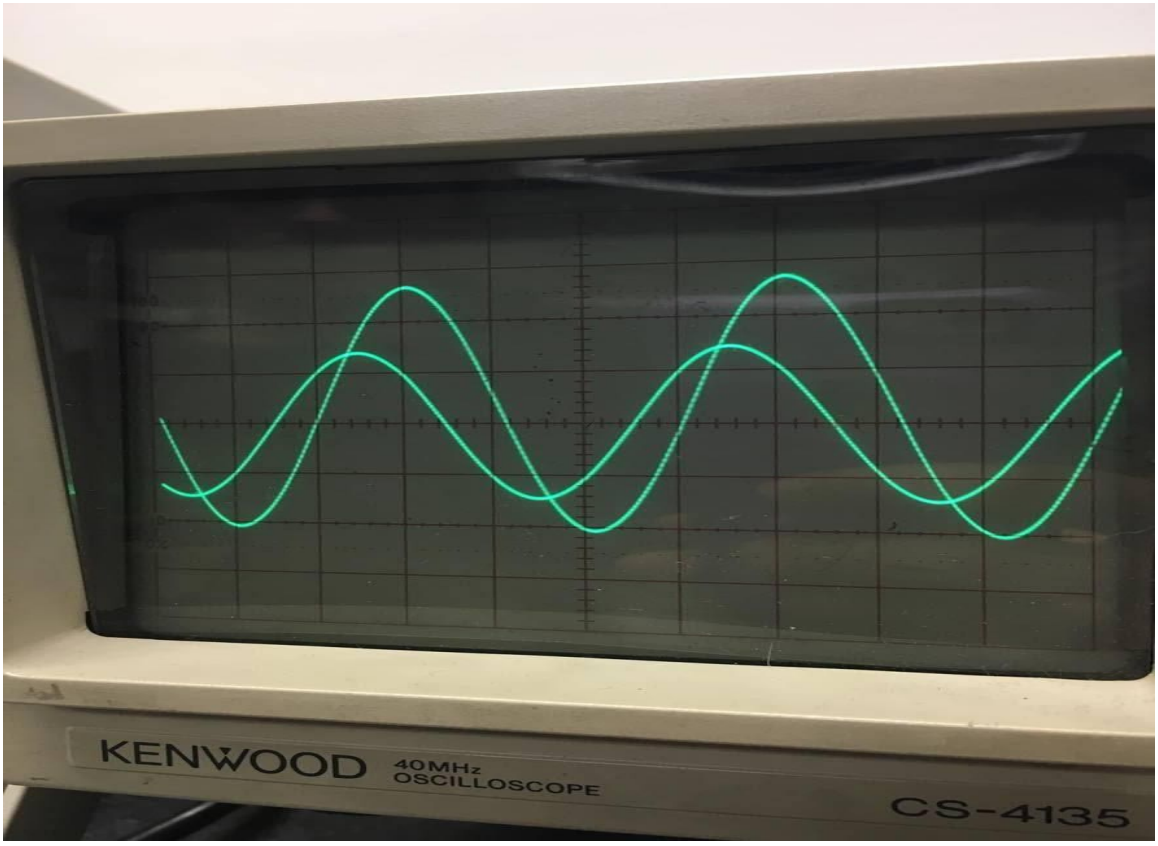
Filters can be classified as high or low pass. A low-pass filter allows the lower-frequency components of the applied voltage to develop output voltage across the load resistance and the higher frequency is diminished in the output. This can be seen in the graph above.

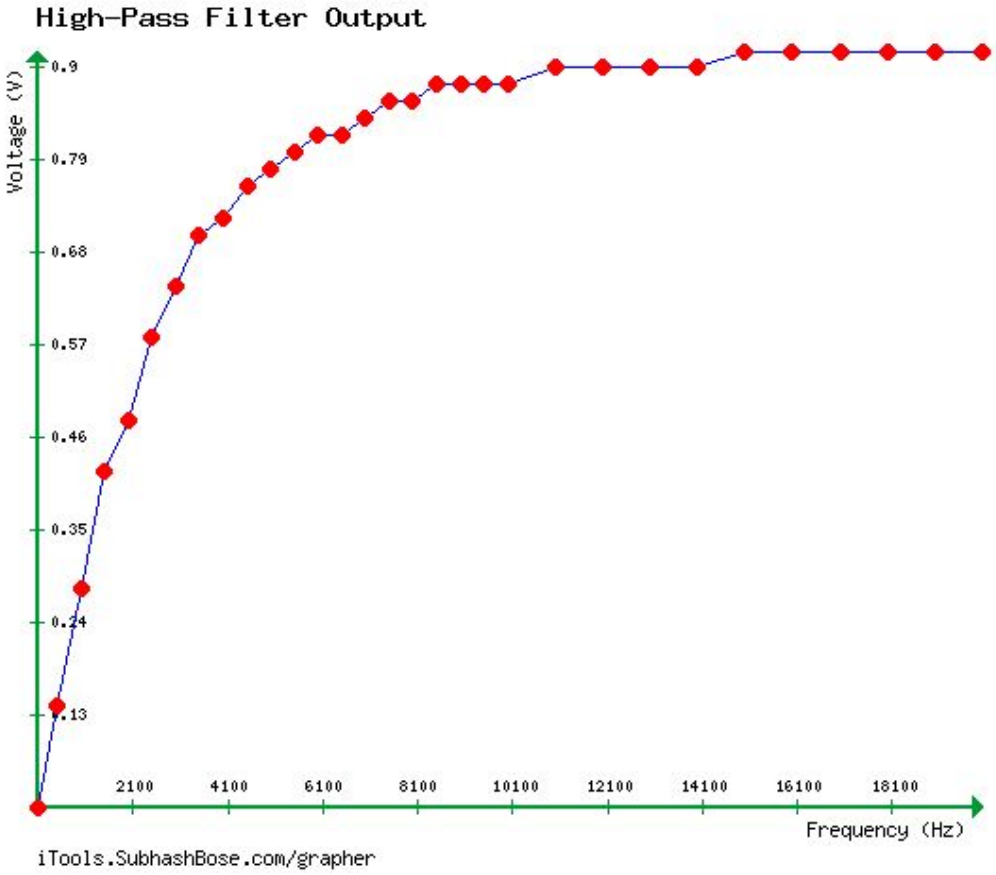
CIRCUIT 2



1. Swap the position of the capacitor and the resistor and then repeat the experiment again.
2. Plot the graph for the High-Pass Filter

INPUT/SUPERIMPOSED GRAPH OF HIGH-PASS





ANALYSIS OF GRAPH

A high-pass filter allows the higher-frequency components of the applied voltage to develop output voltage across the load resistance and the lower frequency is diminished in the output. This can be seen in the graph above.

CONCLUSION

By using a capacitor and resistor you can isolate or block a steady dc voltage.

SOURCES

Grob's Basic Electronics 11th Edition