# Birzeit University
# Physics 112

Experiment #10

# Filter

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**Abstract:**

- **The aim:** how to find the integration and differentiation using the filter circuits: Low-pass filter and High-pass filter.

- **The method:** by found the border between high and low attenuation for filters by using the CRO to see the plot of the capacitance's voltage vs. time and get the value of the voltage

- **The main Result:**

ω Theoretically: 1/RC = 10000 rad/sec

ω from the graph of A vs. ω for the low pass filter

(A=0.707) ≈ 10.8*10^3 rad/sec.

ω from the graph of A vs. ω for the high pass filter

(A=0.707) ≈ 11.2*10^3 rad/sec

## Introduction:

A filter is an electrical circuit that allows signals with a defined frequency range to pass while blocking others with different frequency ranges. Filters are useful units in many electrical and electronic devices such as radio, TV, etc.

The types of filter :

### 1- Low-pass RC filter

Using the generalized Ohm's law we can obtain the output voltage, V out, as a function of the input voltage, Vin.

$$V\ out(t)=V\ in(t)/1+j\ w\ RC$$

And the attenuation factor takes the following form:

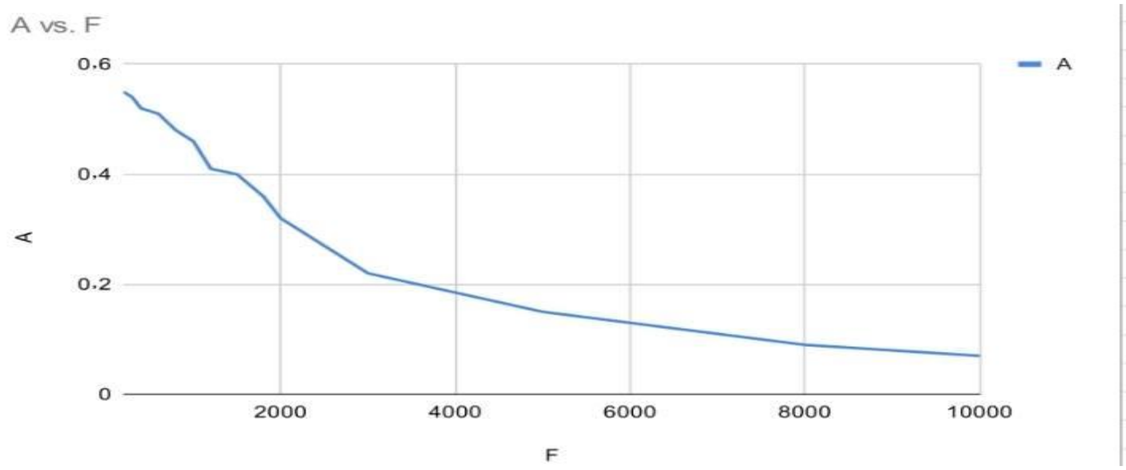
$$A=1/(1+(w/w\text{-}3dB)\ ^\wedge 2)\ ^\wedge 0.5$$

### 2- High-pass RC filter

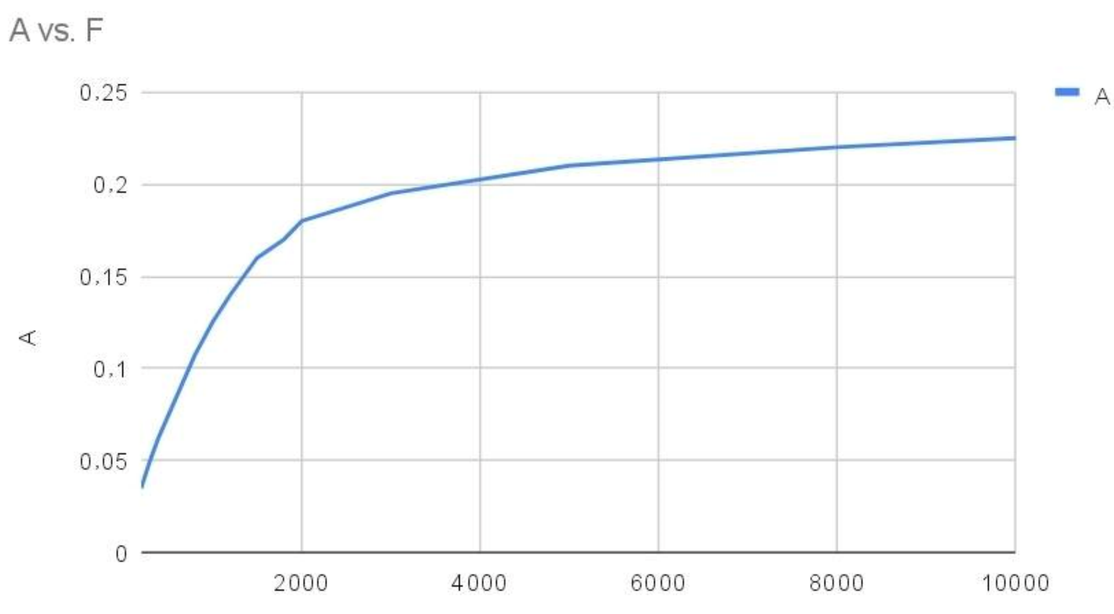
The attenuation factor. A can be deduced using exactly the same procedure used in case of the low-pass filter, this gives:

$$A=1/(1+(w/w\text{-}3dB)\ ^\wedge 2)\ ^\wedge 0.$$

## The Graphs




Attenuation factor A as a function of frequency for Low-pass filter




Attenuation factor A as a function of frequency for High-pass filter

## Results and Conclusion:

The difference between low-pass and high-pass filters and what their omega for the cut off frequency is, as well as how to find the integration and differentiation using the filter circuits: Low-pass filter and High-pass filter. To begin, the theoretical value of omega was found to equal to 10000 rad/sec which was relatively close to the experimental values found in the Attenuation vs. Omega graphs for both circuits.

As we can see from the results that we've got, the high-pass filter acts as a differentiator and the low-pass filter acts as an integrator.

The results we have experimentally is near the once we have Theoretically but there are some errors.

The experimental values of ω -3dB for the high-pass and low-pass filters were both equal to 9420 rad/sec, meaning that a practical boundary between passed signals and highly attenuated ones were set to the half of their maximum power which proves the equation