Electric Circuits II Project

Report

Prepared by

Mark Raymond Takla

Theoretical background:

We chose the Band Pass filter circuit 5 (Sallen Key / Cascaded band pass filter).

Equations used:

1. Gain = $V_{out}/V_{in} = V_{out}$ as $V_{in} = 1V$

2.

Lower cutoff Frequency	$f_L = \frac{1}{2\pi\sqrt{2}\,R_1C_1}$
Higher Cutoff Frequency	$f_H = \frac{1}{2\pi\sqrt{2}\,R_2C_2}$
Center Frequency	$f_0 = \sqrt{\omega_L\omega_H}$

Filter design:

Values:

R_1 = 1k ohms, R_2 = 100k ohms

C_1 = 10nf, C_2 = 22pf

Therefore f_L = 11253.9 kHz, f_H = 51154 kHz, f_0 = 23993.4 kHz

We also obtained from the AC Sweep graph

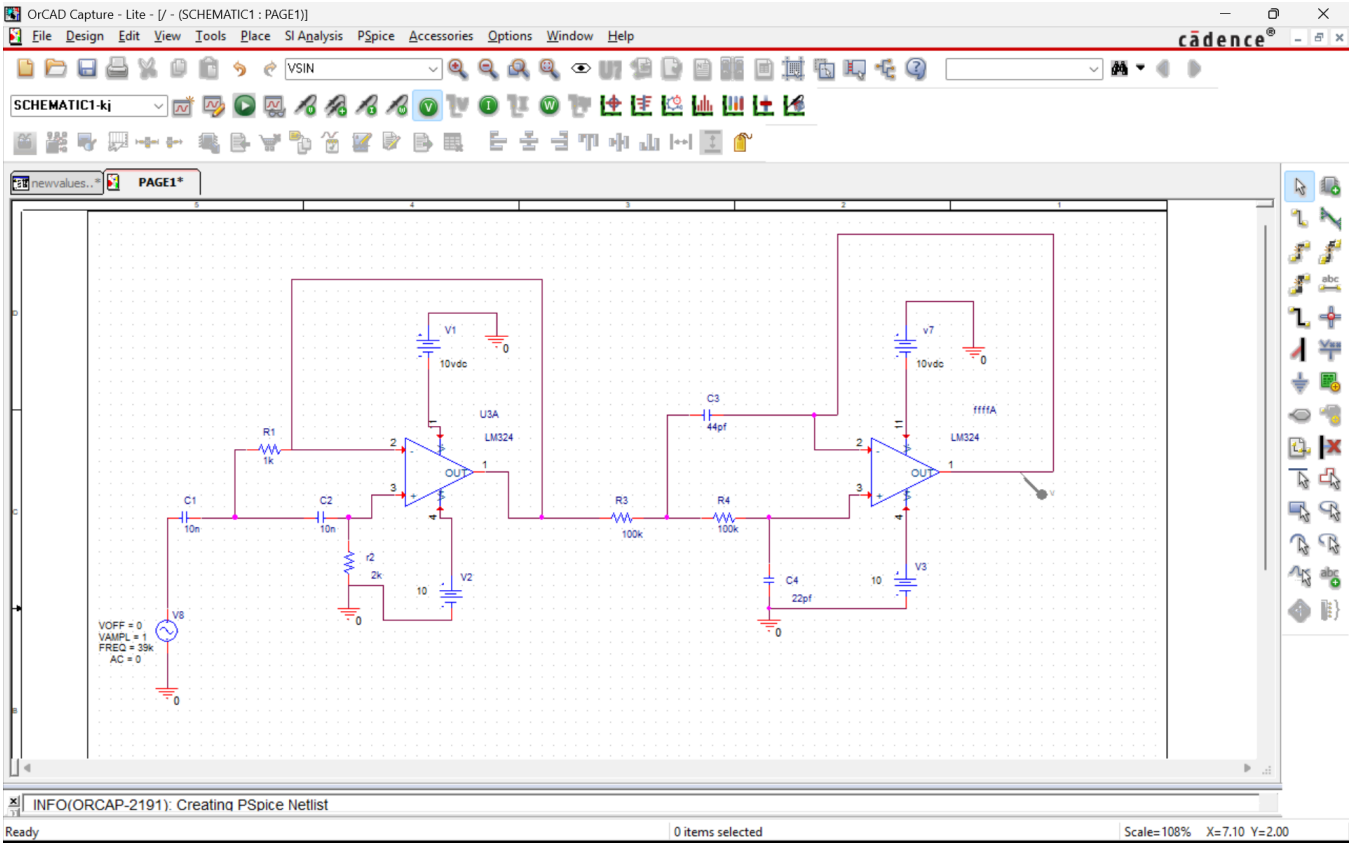
f_1 = 11.9 kHz ($<f_0$)

f_0 = 24 kHz (peak)

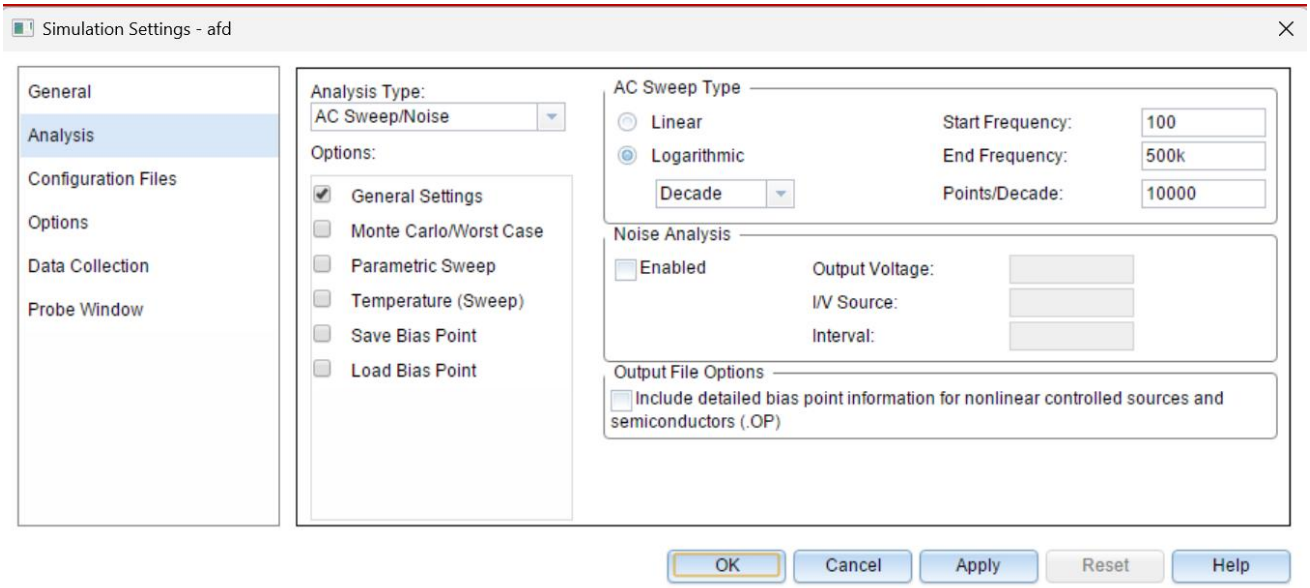
f_2 = 39 kHz ($>f_0$)

Circuit simulation:

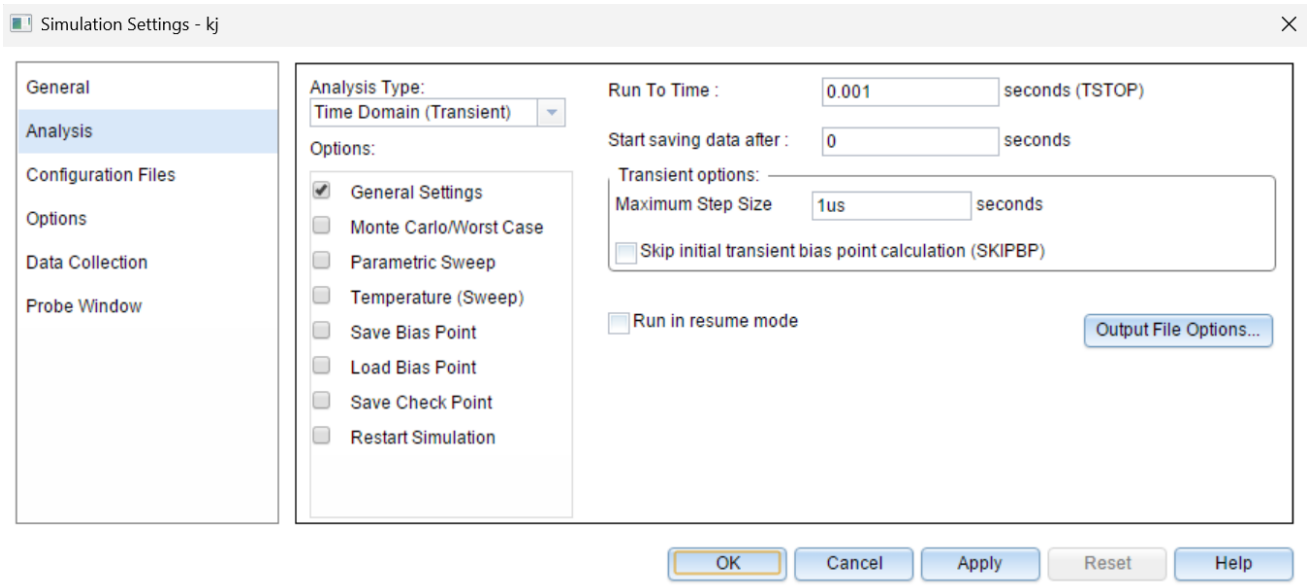
Circuit Design on Capture:



AC Sweep Simulation Profile:



Time Transient Simulation Profile:



Simulation results:

Screenshots for the obtained simulation results and comments on the simulation results.

You need to run two simulation profiles:

i. AC sweep simulation:

Sketch of the gain versus the frequency, where Vac is used as the input signal (One sketch is required).

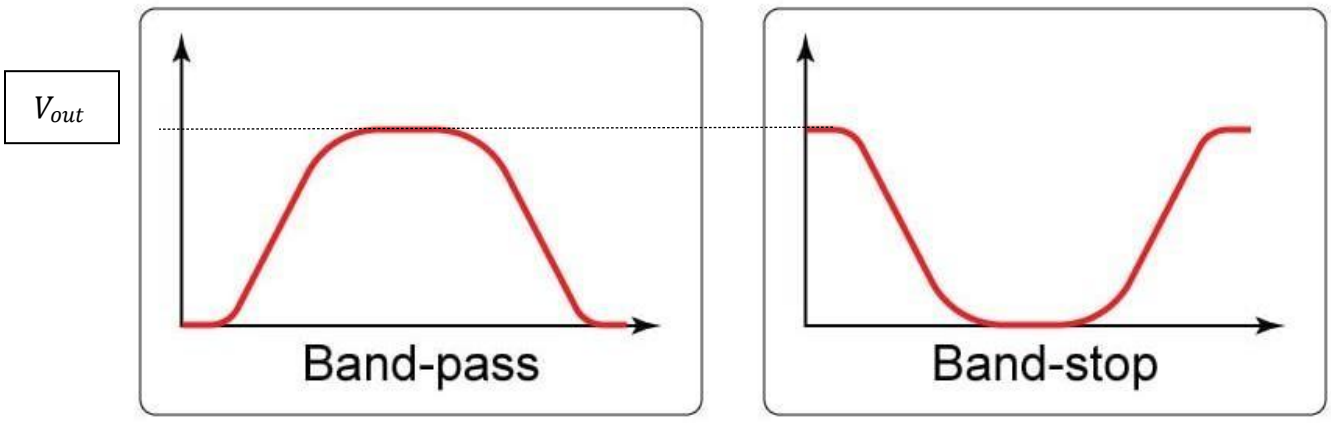
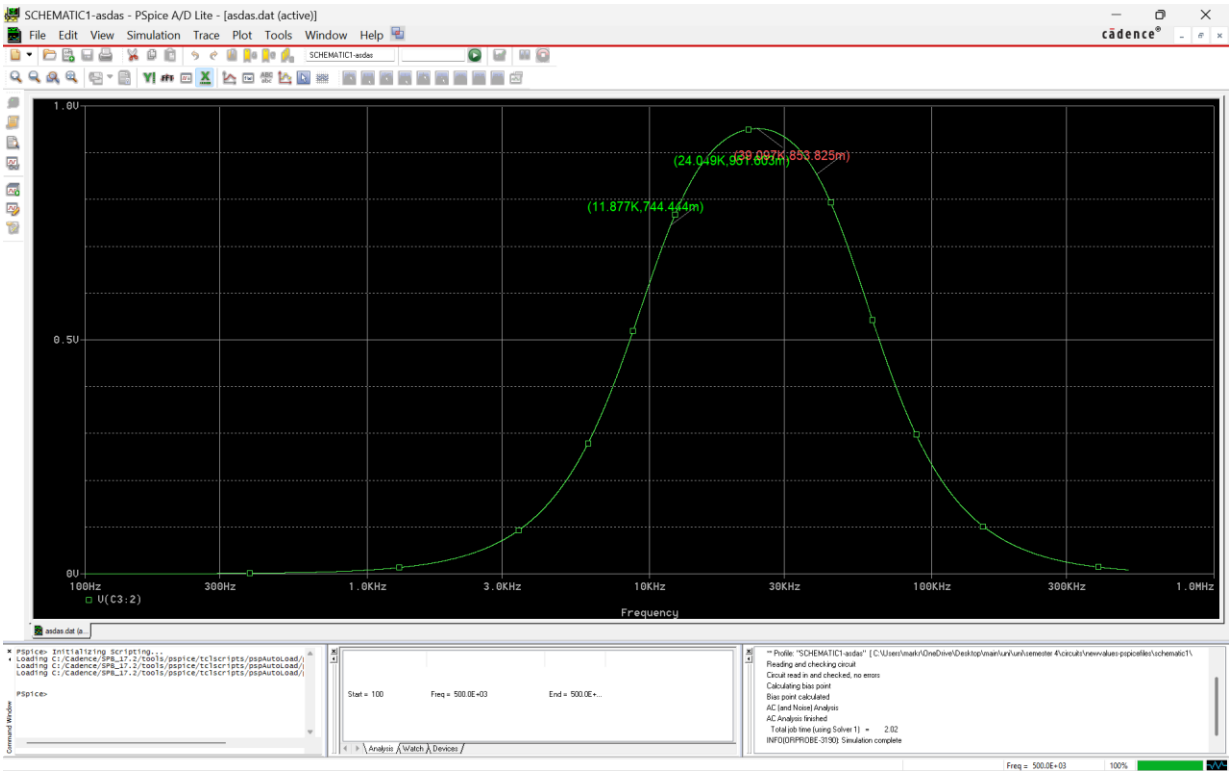


Figure 1 Expected outcome for the AC Sweep

AC Sweep Results:

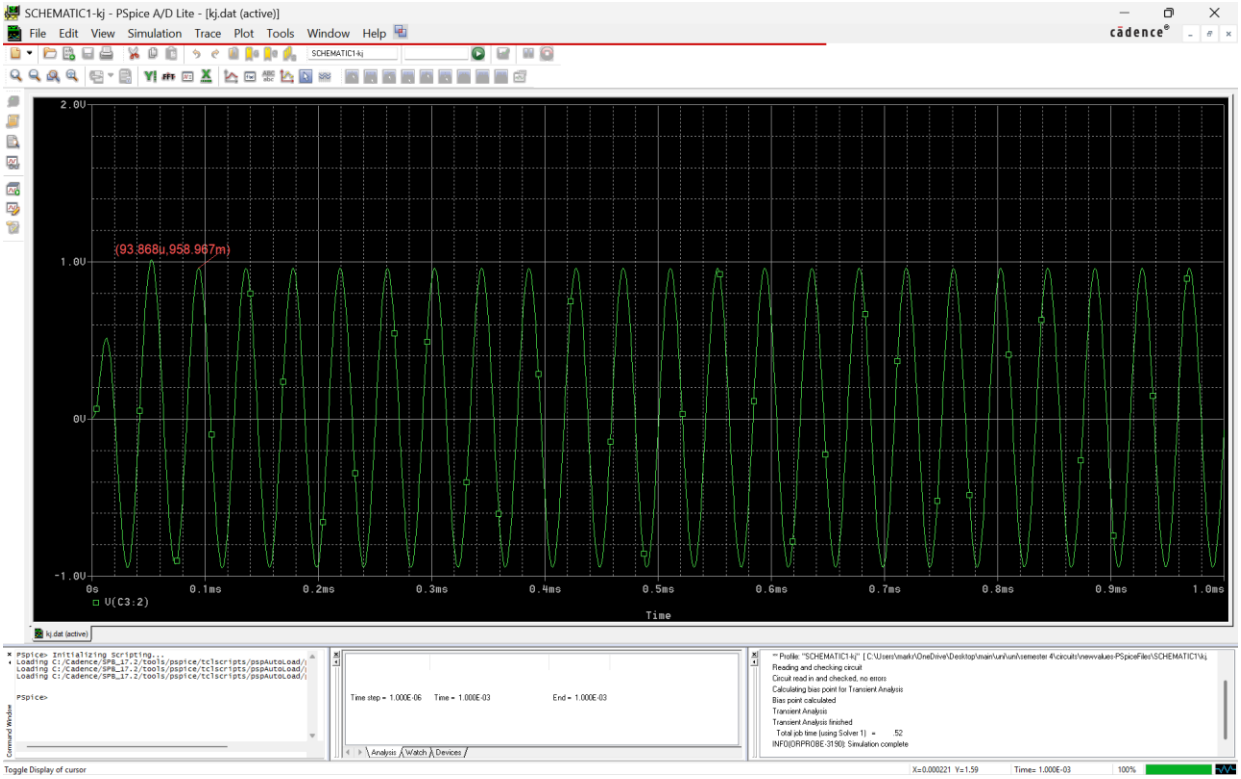


ii. Time domain simulation:

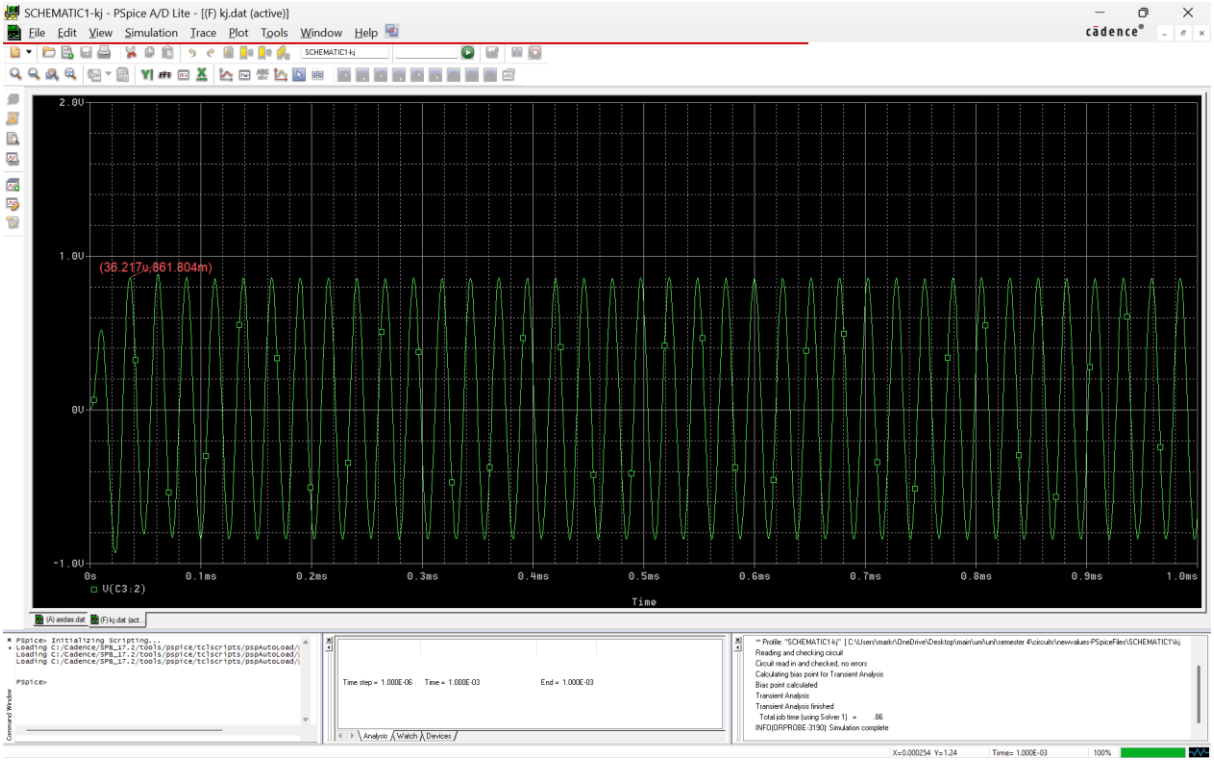
Sketch of voltage amplitude versus time, where Vsin is used as the input signal at three different frequencies (f < fo , f = fo and f > fo).

Time Transient Results (f_1 = 11.9 kHz):

Time Transient Results (f_0 = 24 kHz):



Time Transient Results (f_2 = 39 kHz):

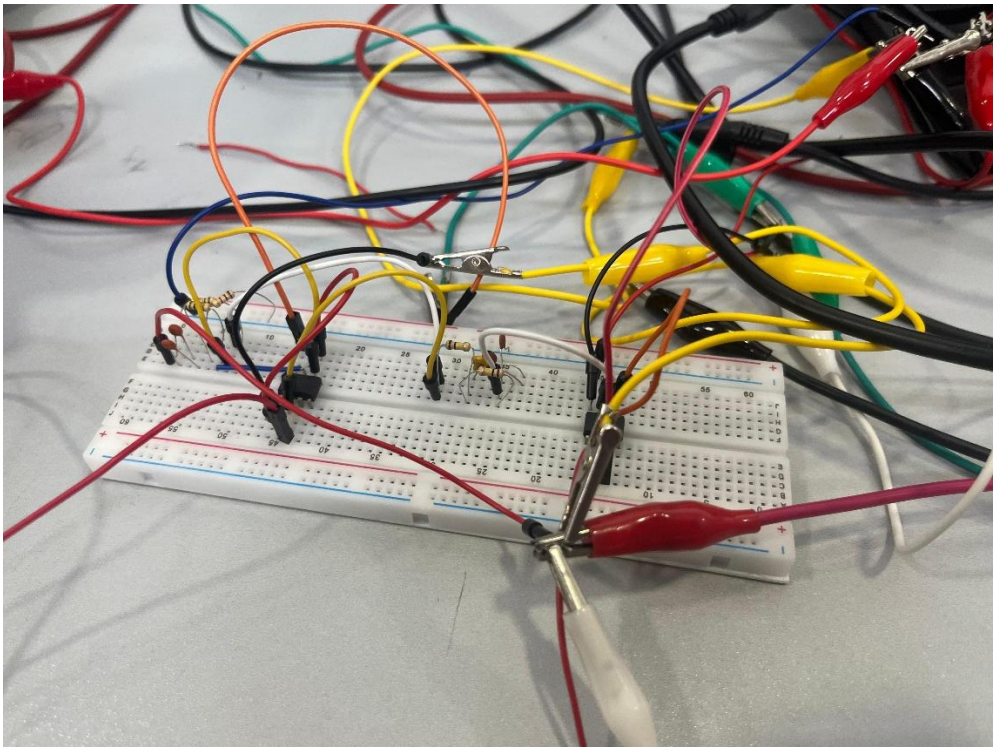


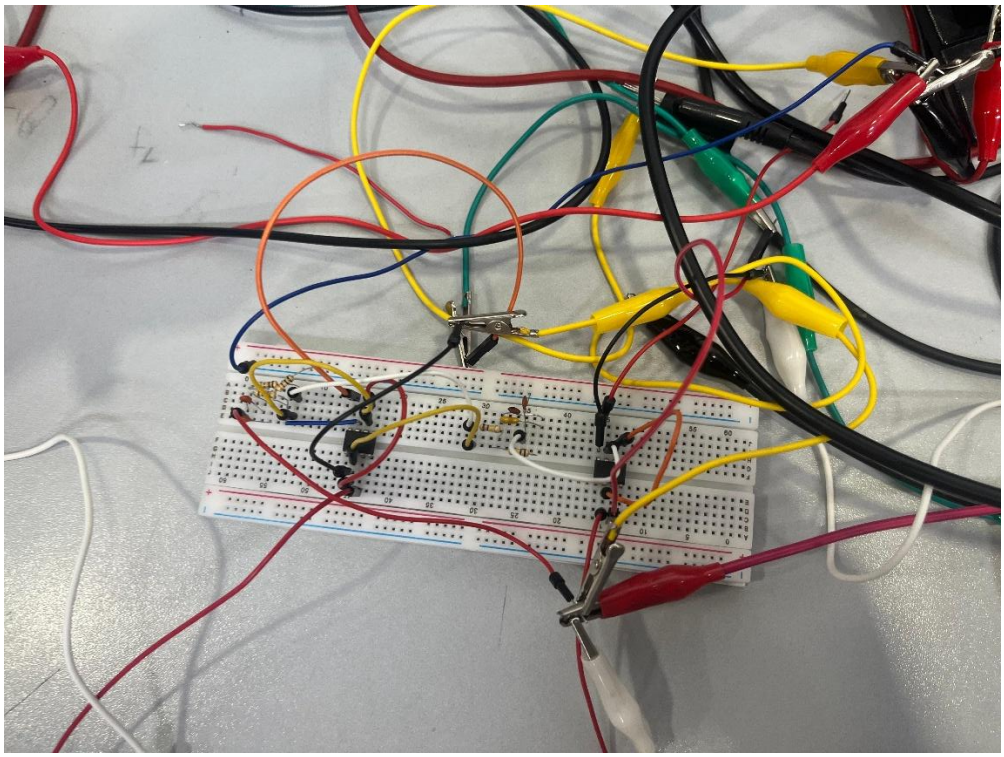
Hardware implementation:

Purchased components:

- 3 1k ohms resistors
- 2 100k ohms resistors
- 2 10 nf capacitors
- 3 22 pf capacitors
- 2 Lm741 op amps
- 1 breadboard
- Wires & crocodiles

Hardware Connections:



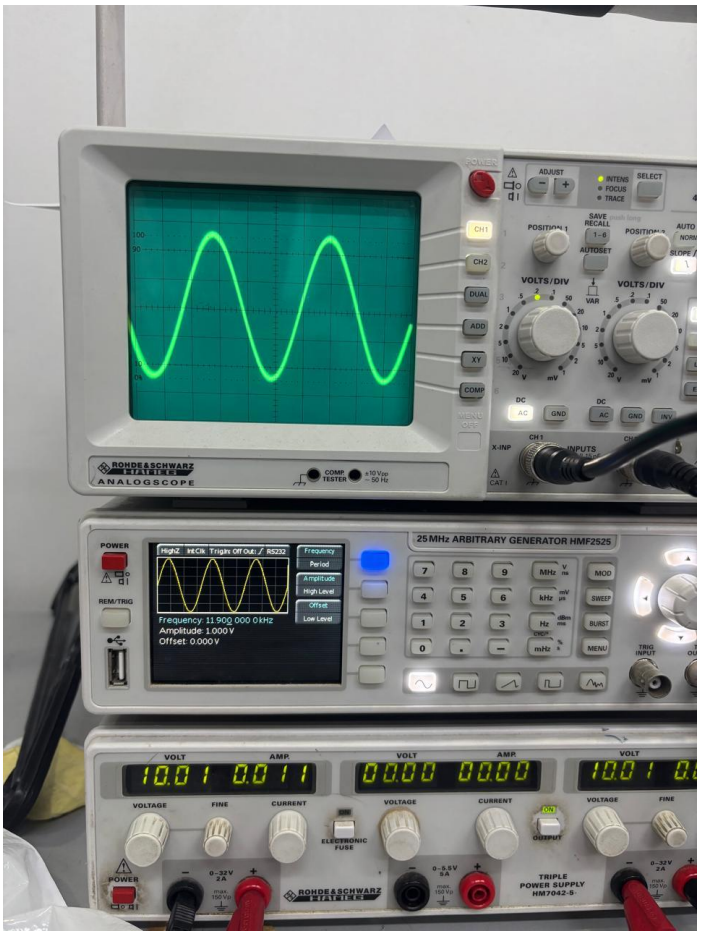


Hardware results:

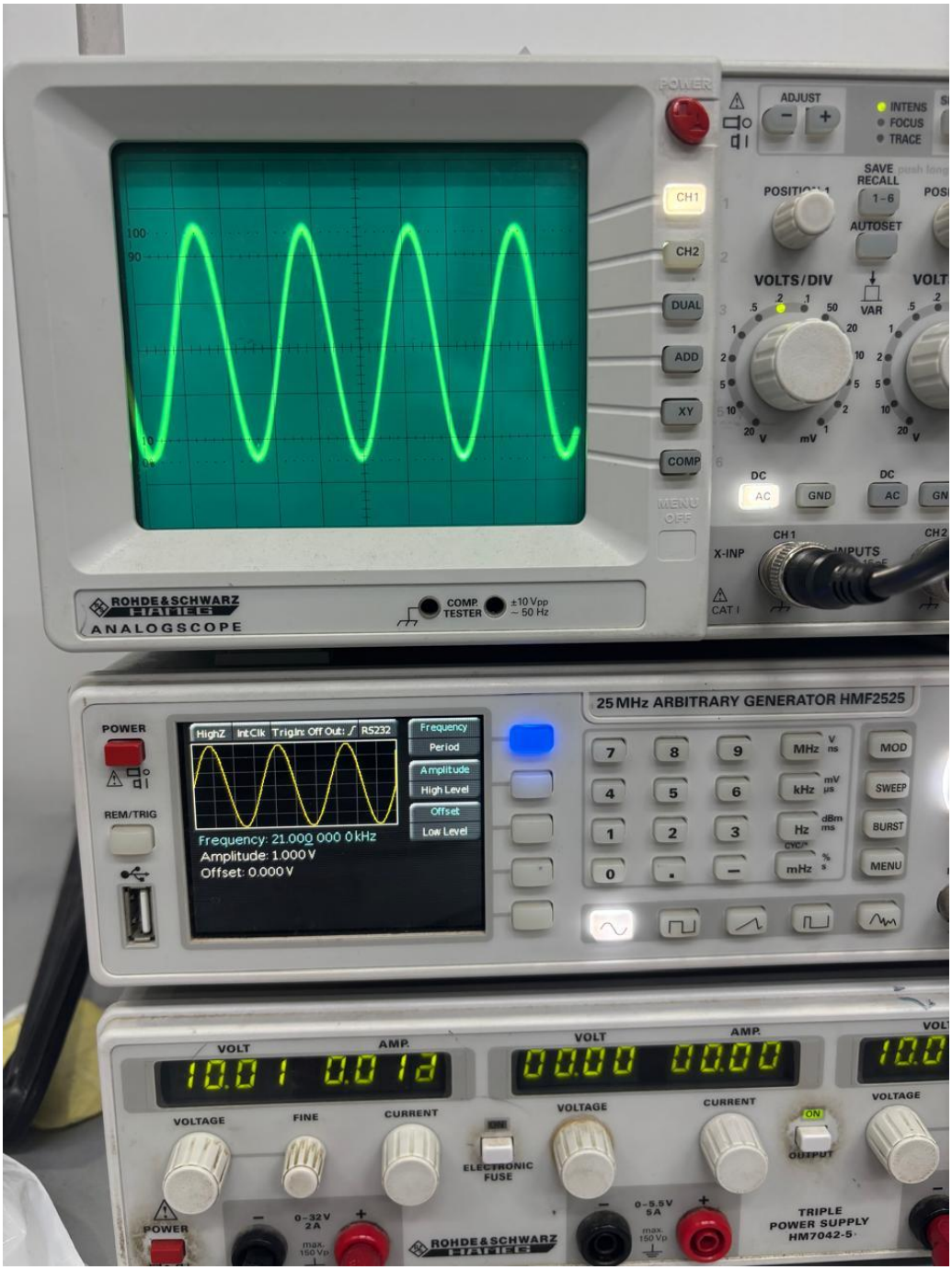
Includes pictures from the oscilloscope for the input voltage and the output **voltage at three different frequencies** (to show that the type of filter).

Includes also discussion of the results obtained from the hardware implementation.

i. $f < fo$: (11.9 kHz)



ii. $f \approx fo$: **(24 kHz)**



iii. $f > fo$: **(39 kHz)**