ECE113|BASIC ELECTRONICS
Dr. S.S.Jamuar
Lab_7:
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Roll No. : 2020123
Date : 15/8/2021

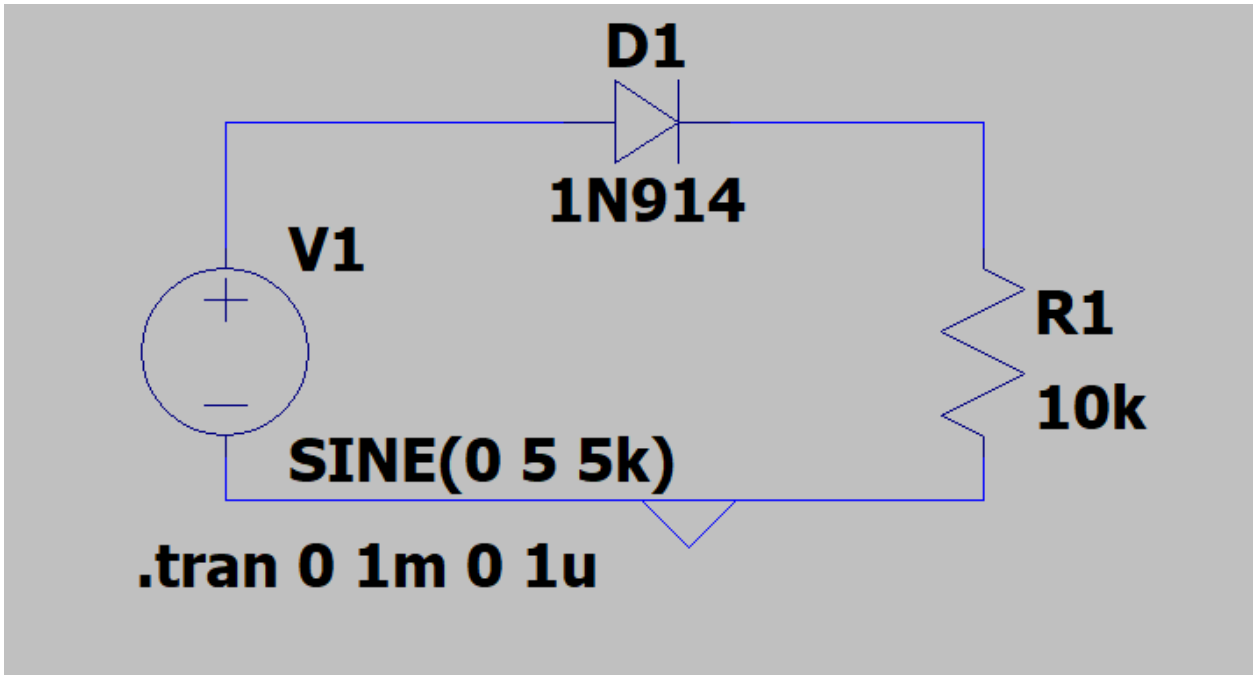
AIM 1 :Simulate Half-Wave rectifier circuit, Diode Clipping circuit, and Diode Clamping circuit and observe the output waveforms on LTspice.

Components Used : voltage source ,resistor , Diode(1N914) ,capacitor , wires.

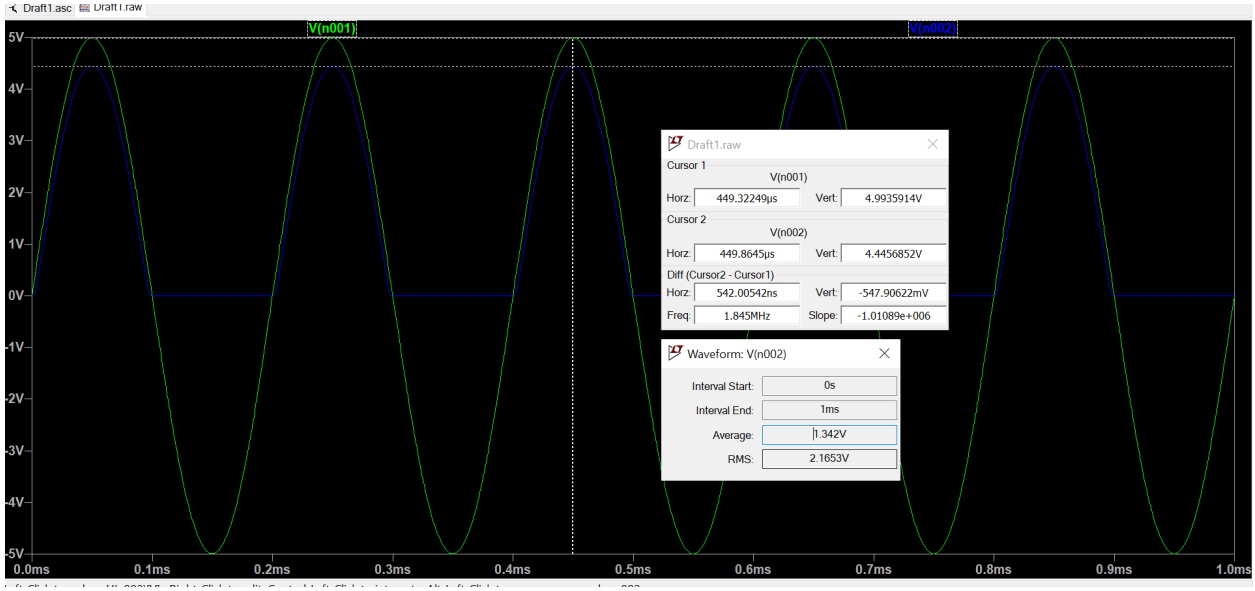
Software used : LTspice

Half Wave rectifier :

1) Circuit :



Waveform :



Peak value : 4.445V
Avg value: 1.342V

Theoretical calculations :

Average value :

$$DC = \frac{V_m}{\pi} - \frac{V_f}{2}$$

$$= 5/\pi - \frac{0.55}{2}$$

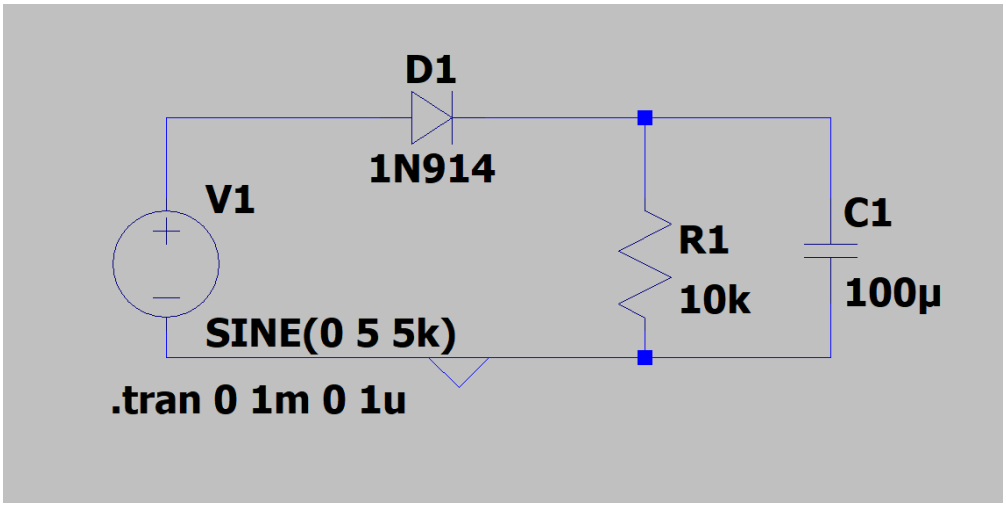
$$= 1.316\ V$$

Peak value $= V_m - V_f$

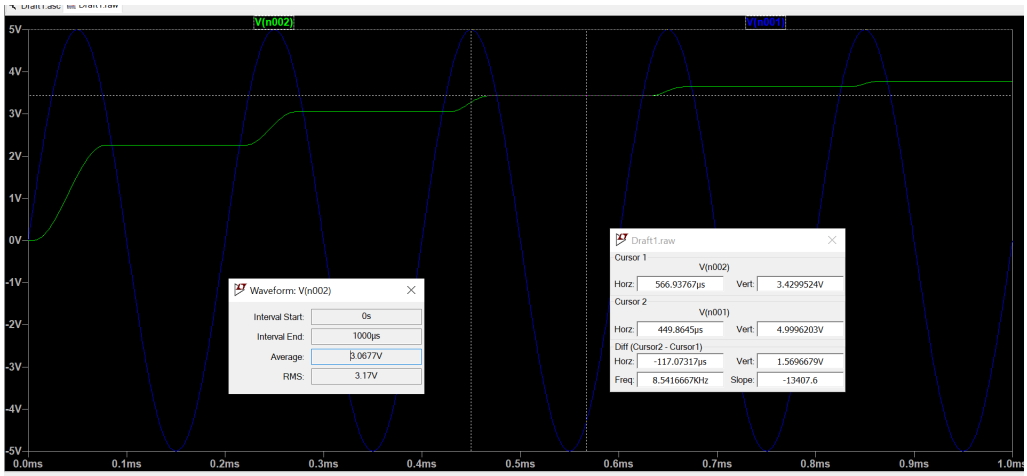
$$= 5 - 0.55$$

$$= 4.45\ V$$

2) **Circuit :**



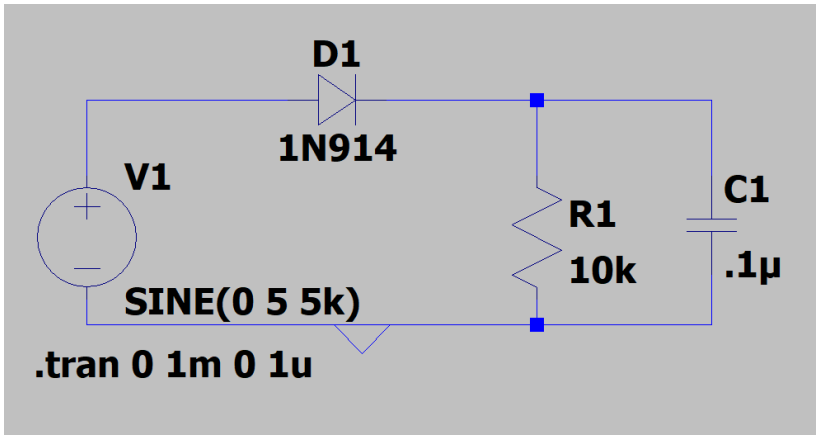
Waveform:



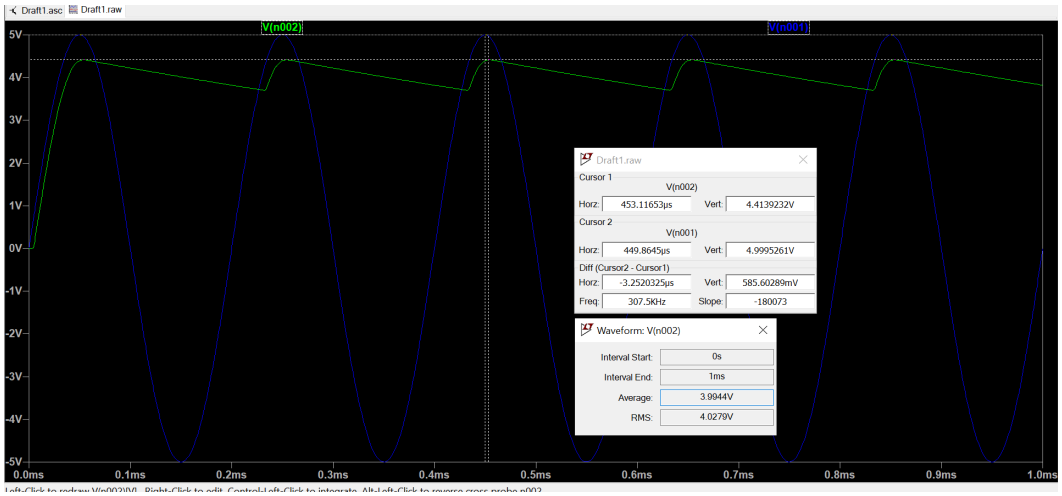
Peak value : 3.43V

Avg value: 3.067V

3) Circuit :

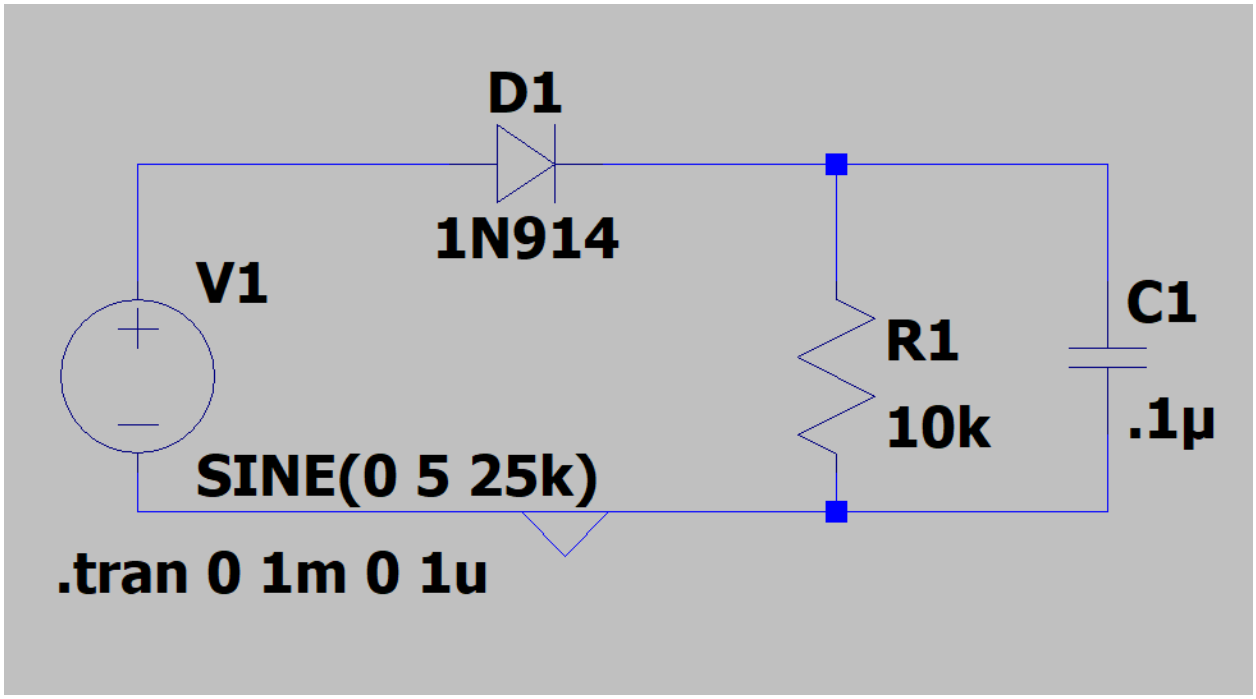


Waveform:

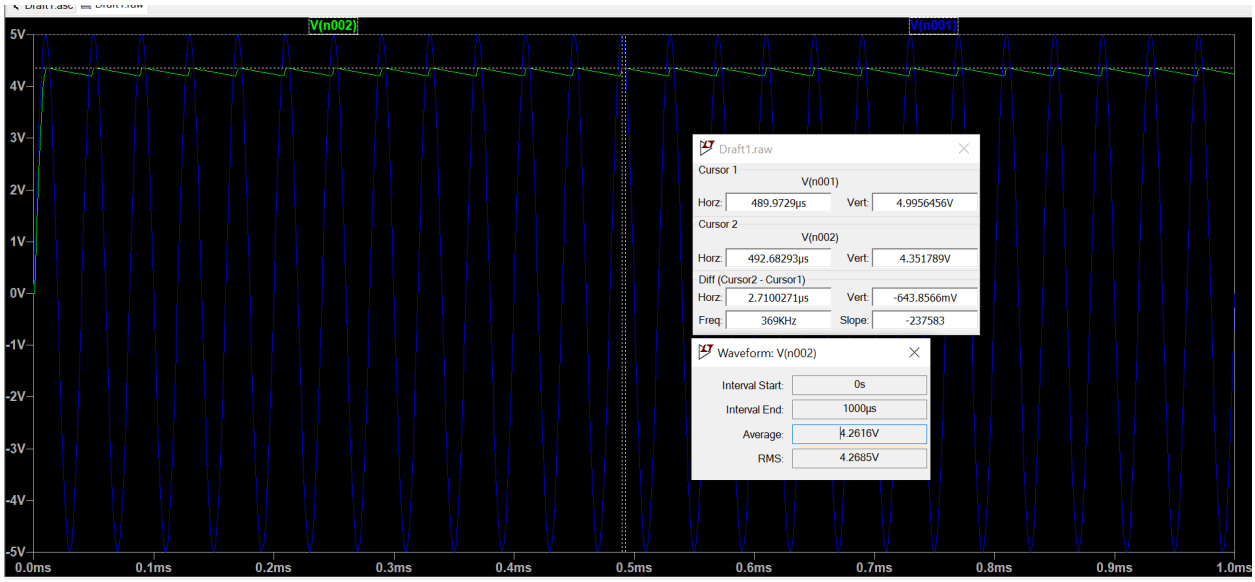


Peak value : 4.41V
Avg value: 4V

4) Circuit :



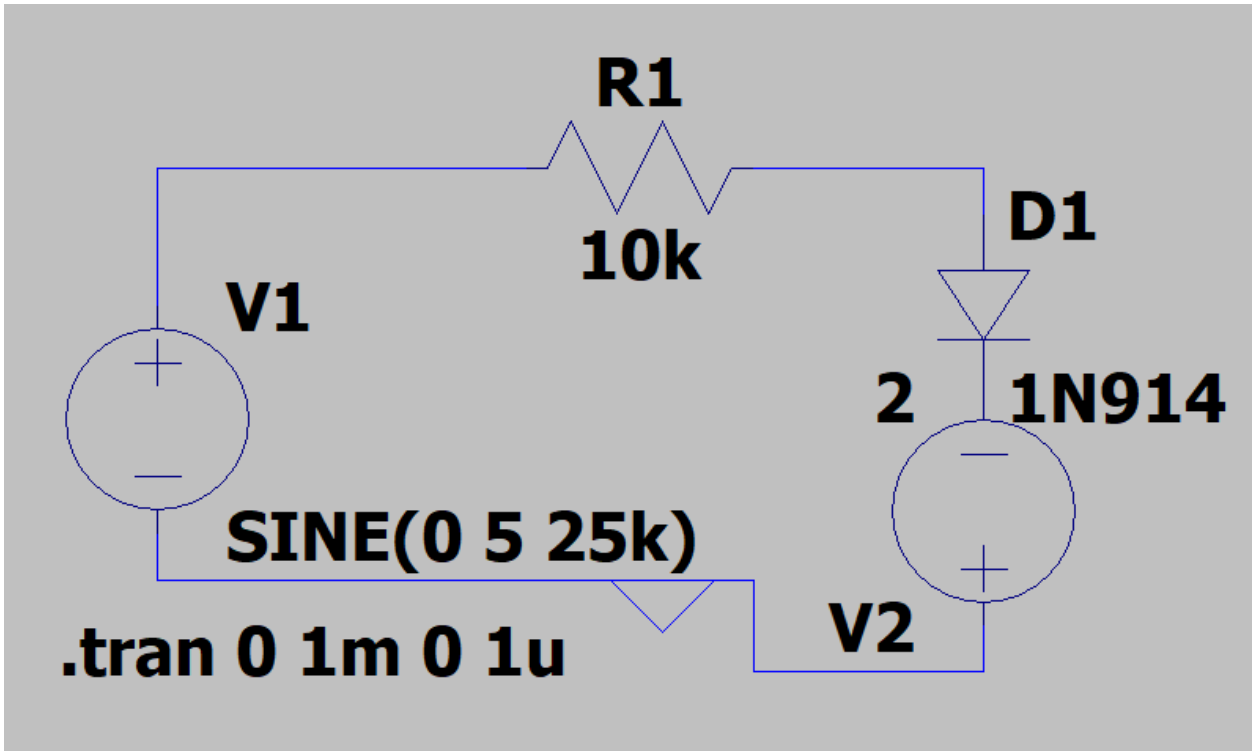
Waveform:



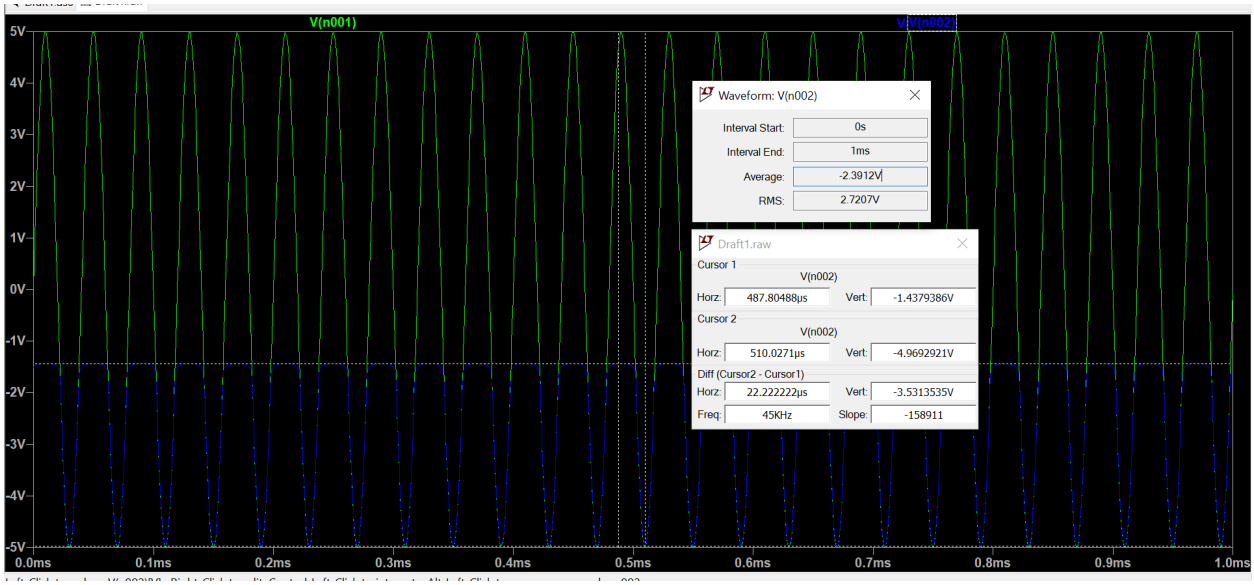
Peak value : 4.35V
Avg value: 4.26V

Diode Clipping Circuit :

1) Circuit :



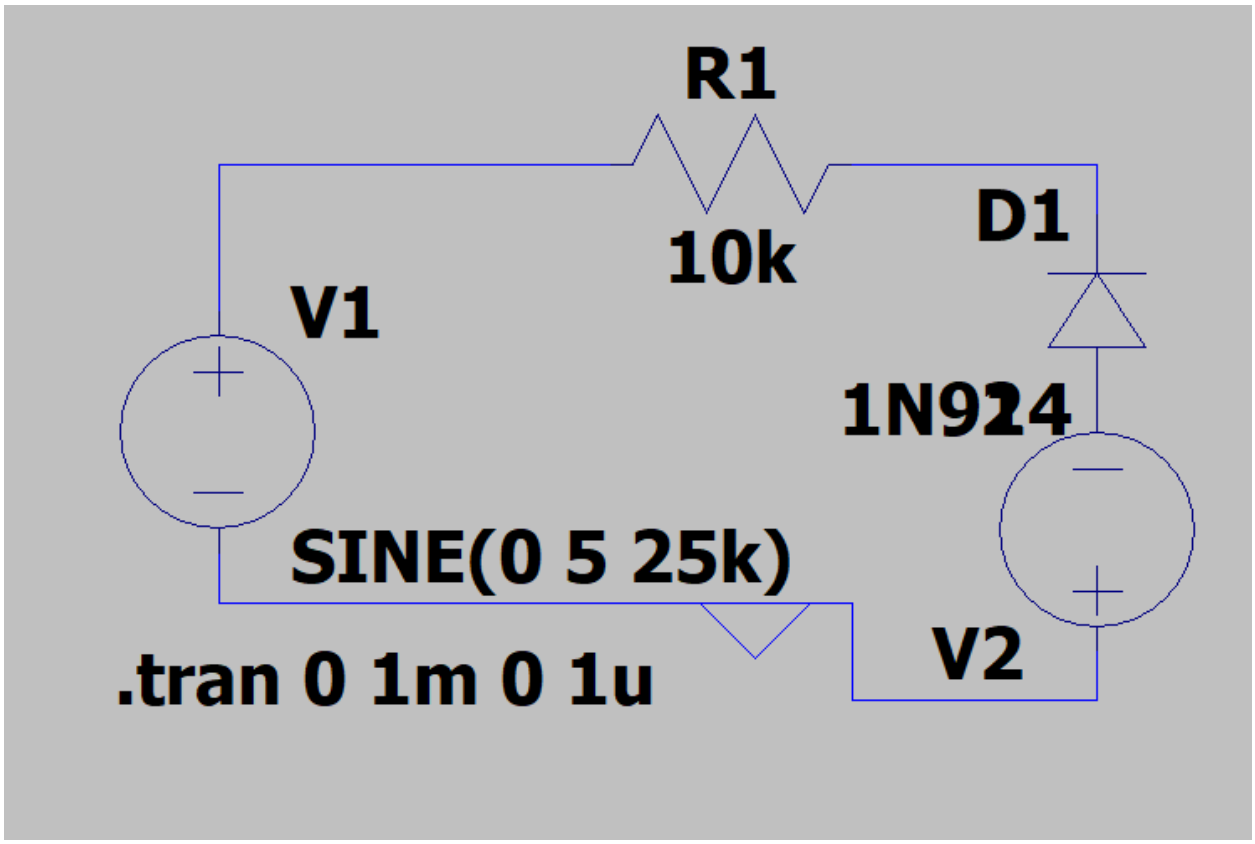
Waveform:



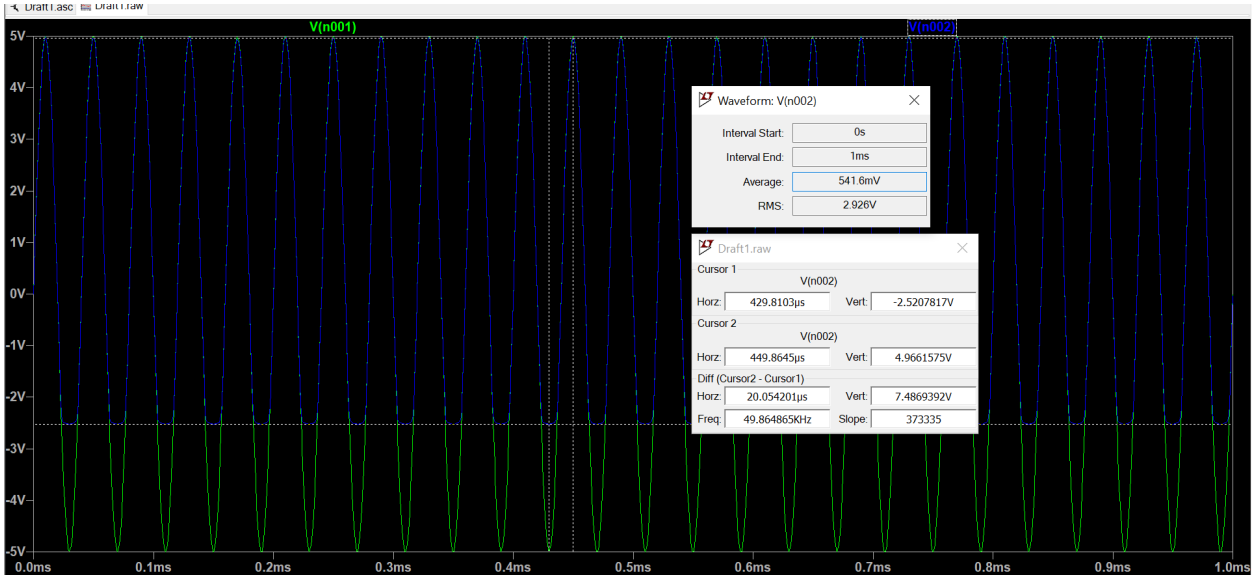
Peak value : -4.97V

Avg value: -2.39V

2) Circuit :



Waveform:

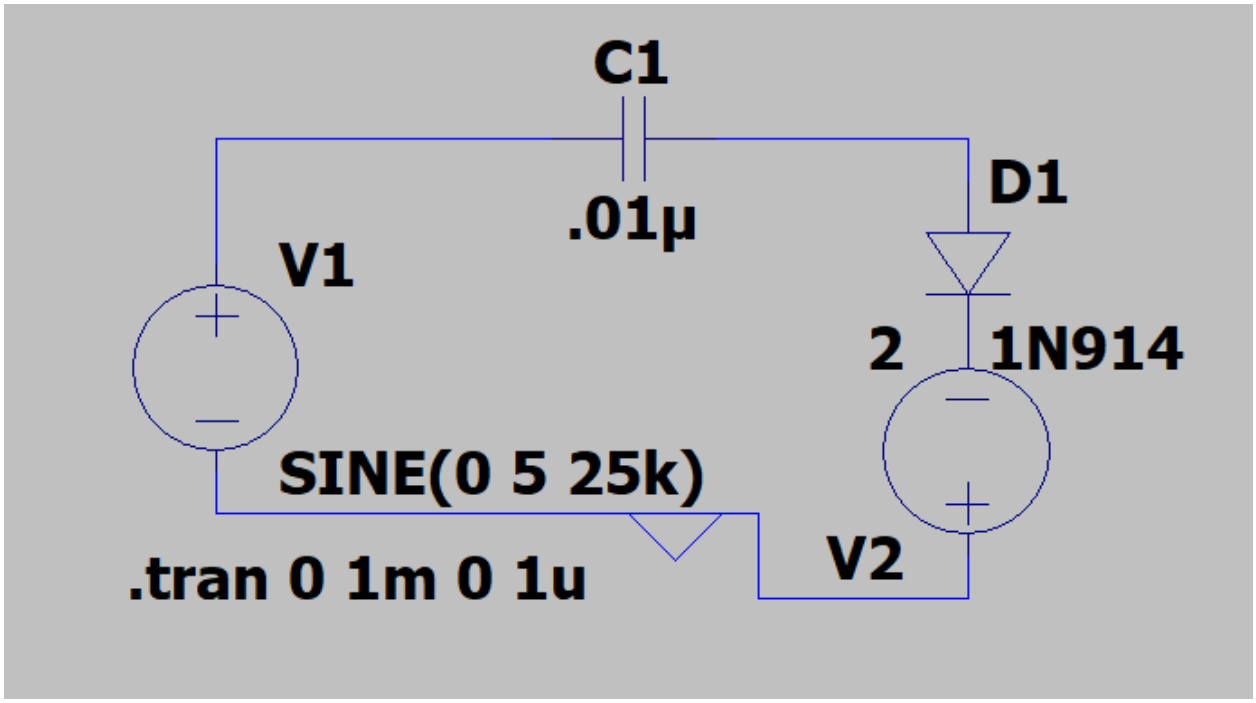


Peak value : 4.96V

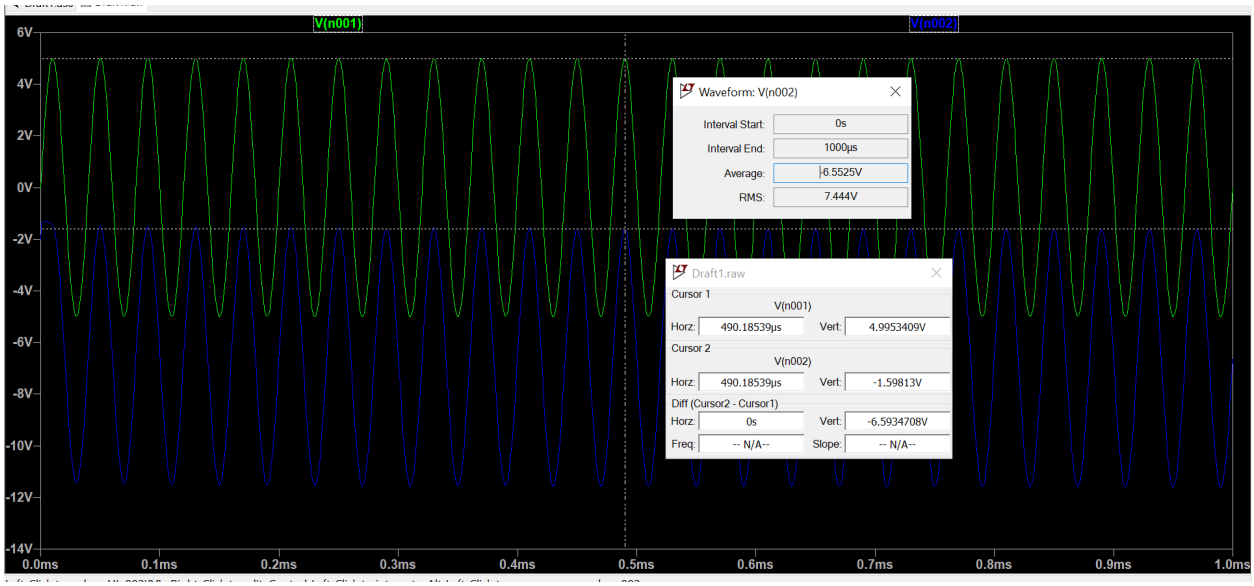
Avg value: .541V

Diode Clamping Circuit :

1) Circuit :

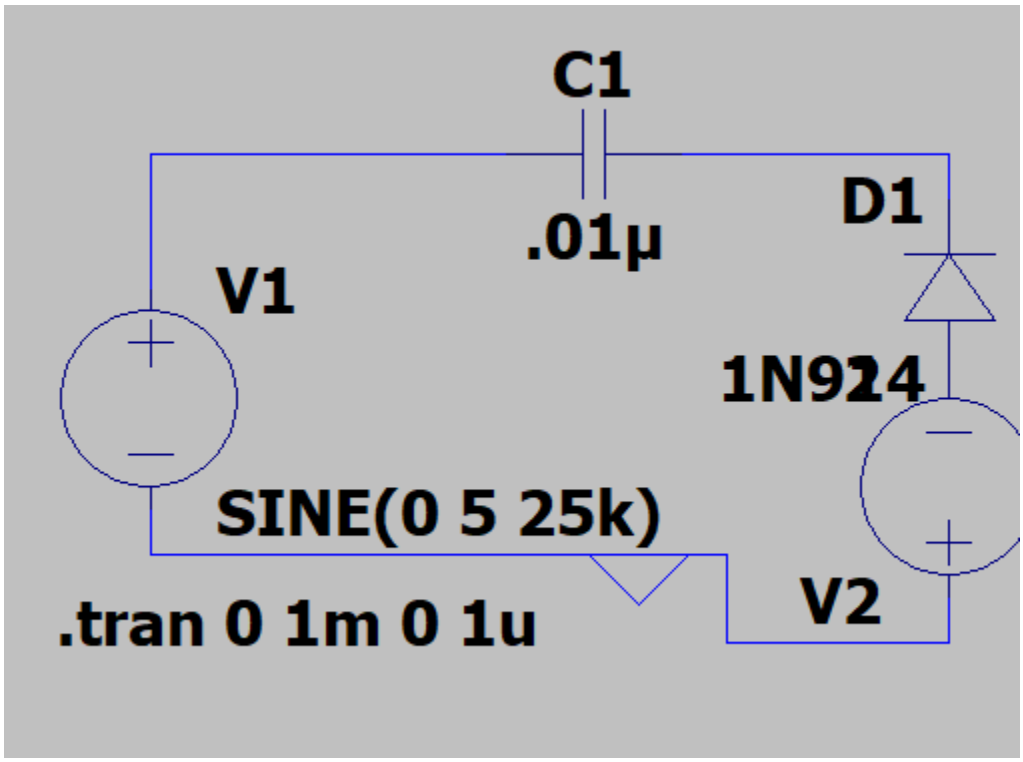


Waveform:

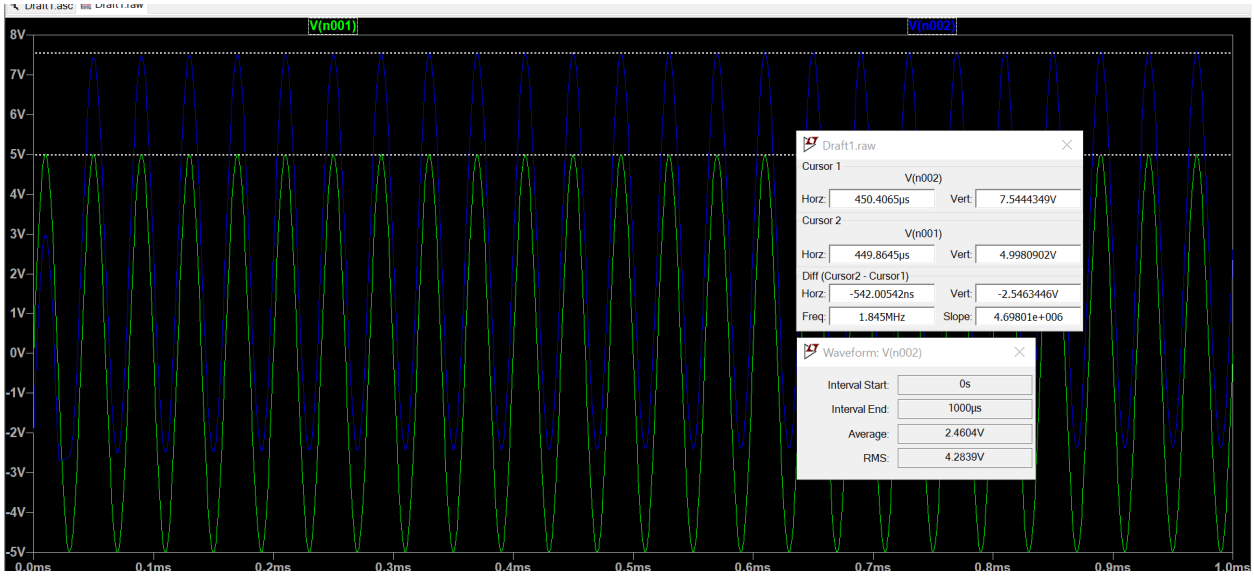


Peak value : -1.59V
Avg value: -6.55V

2) Circuit :



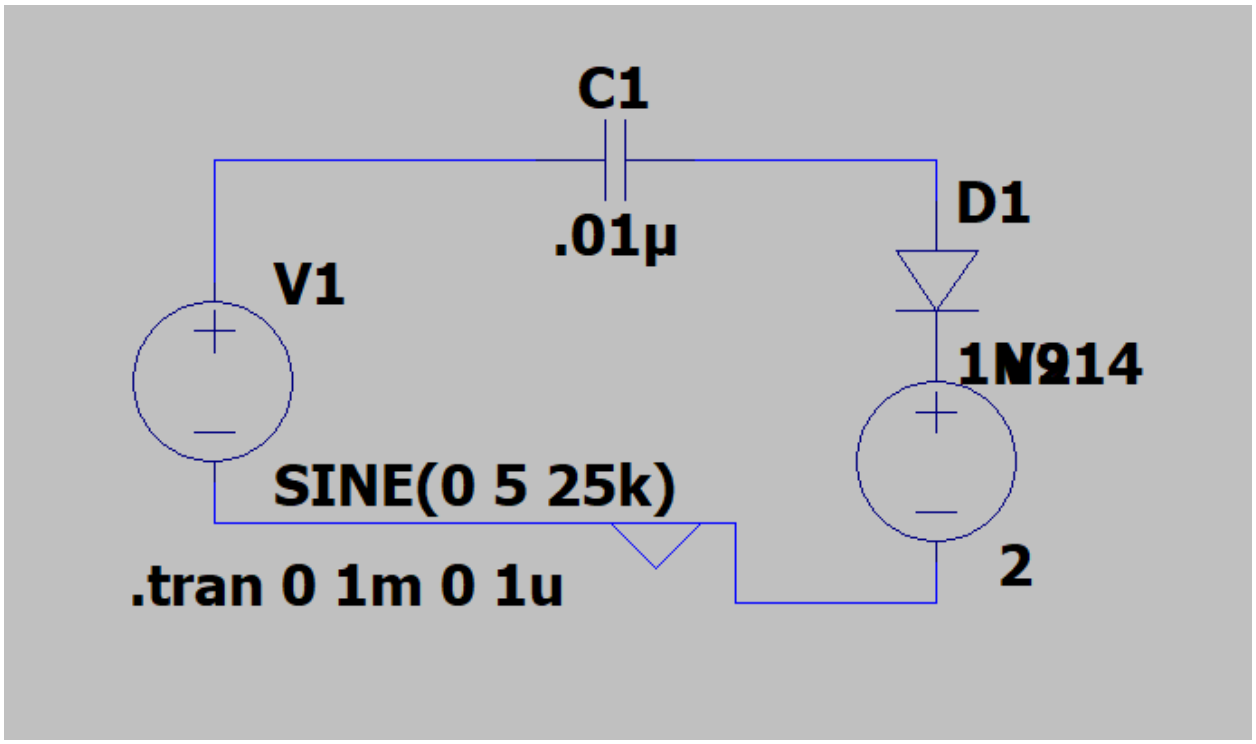
Waveform:



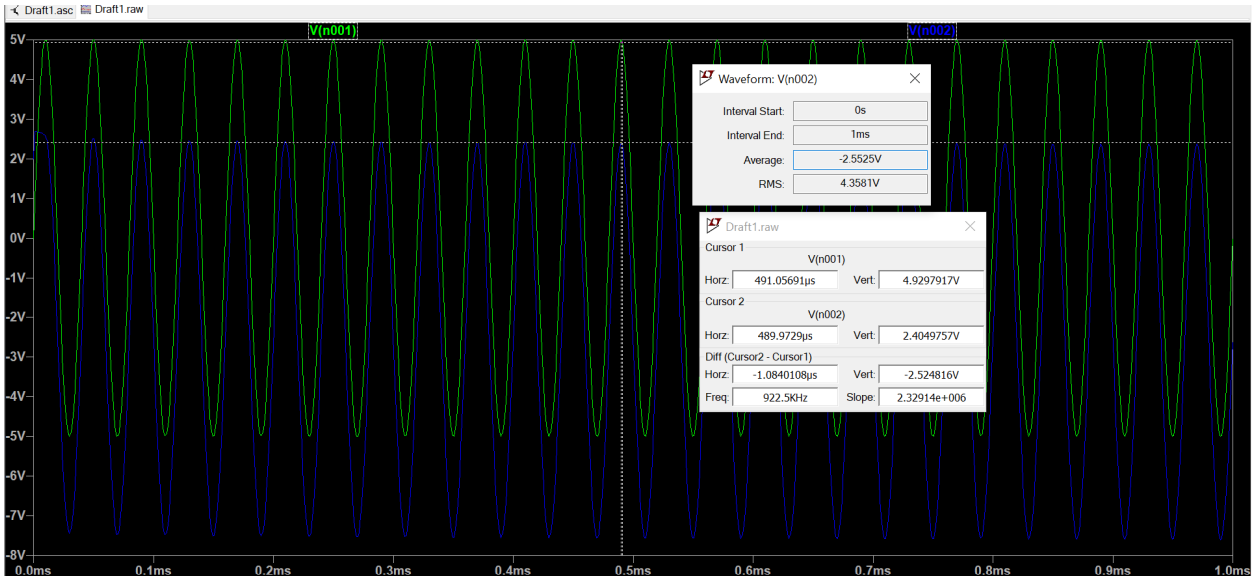
Peak value : 7.54V

Avg value: 2.46V

3) Circuit :



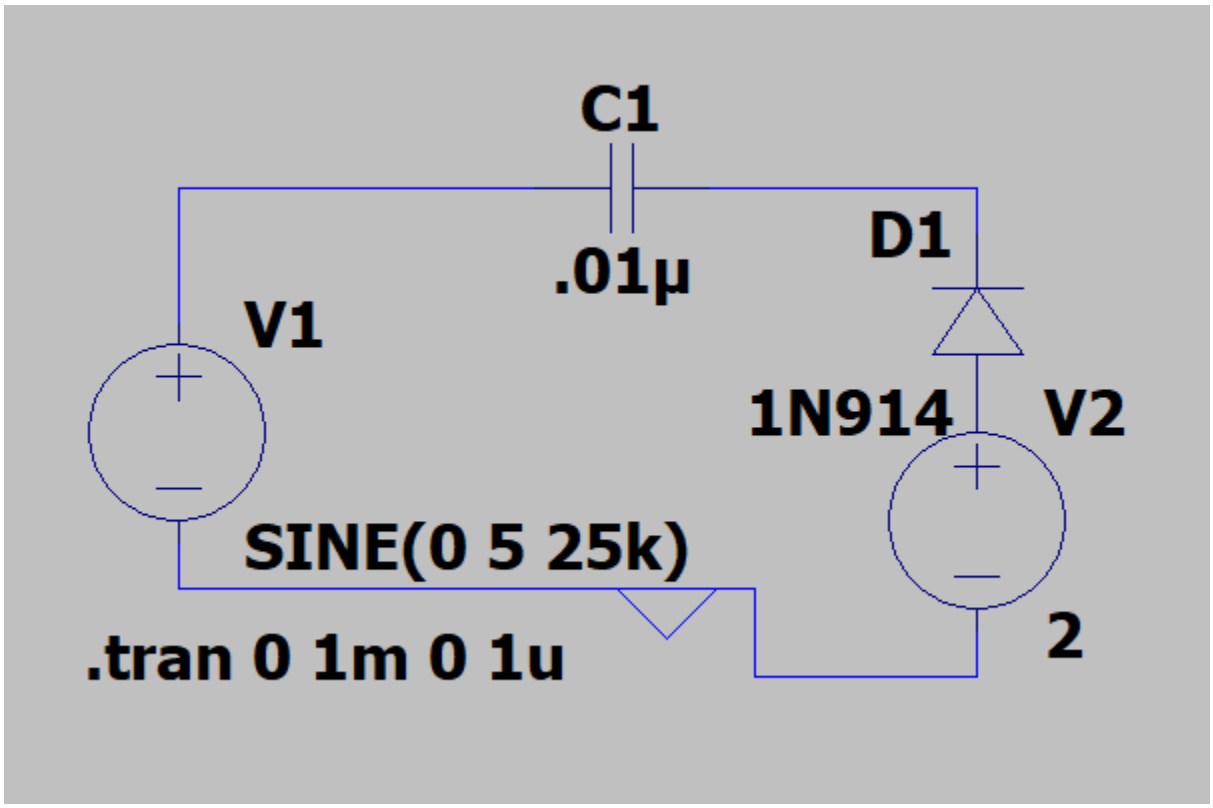
Waveform:



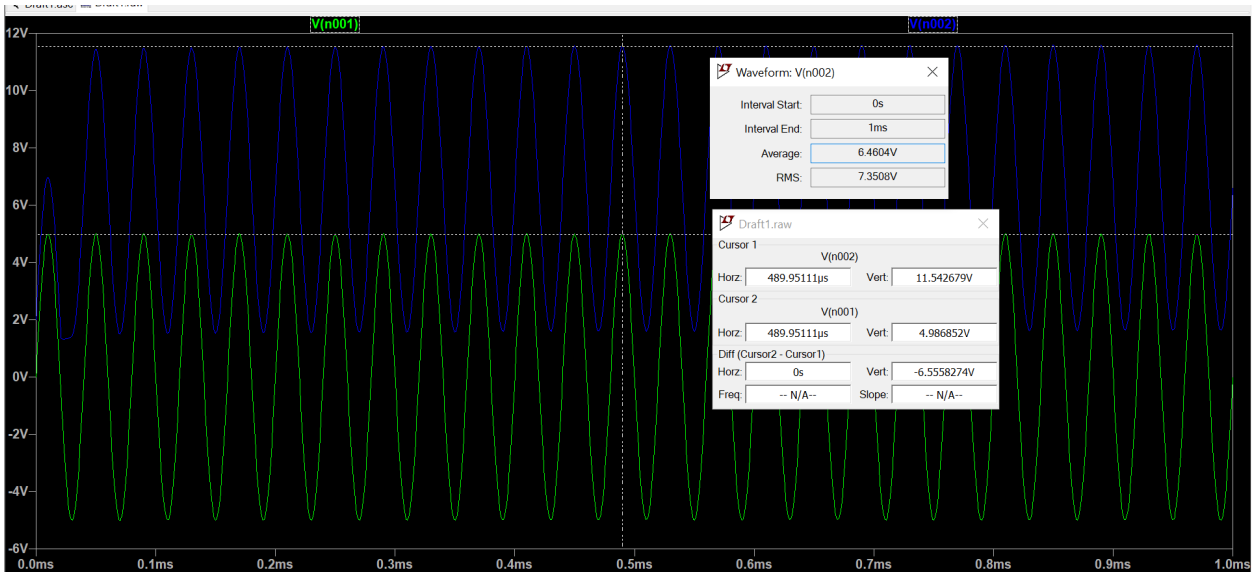
Peak value : 2.40V

Avg value: -2.55V

4) Circuit :



Waveform:



Peak value : 11.54V

Avg value: 6.46V

Observations:

1) **Half wave rectifier :**
    - They only give either the positive or negative voltage output depending on the orientation of the diode
    - When a 100uF capacitor is connected in parallel with the resistor , it takes some time to be fully charged but after that it reduces the ripples in the circuit and circuit almost reaches a steady DC state
    - When a 0.1uF capacitor is connected in parallel with the resistor , it quickly becomes fully charged but as it stores less energy it is not able to maintain the steady DC state for long
    - When a 0.1uF capacitor is connected in parallel with the resistor and frequency is increased to 25kHz, the DC output is a lot steady and the ripples are greatly reduced.(i.e. On increasing frequency the ripples are reduced)

2) **Diode clipping circuit:**
    - This circuit is used to remove (clip) a part of the waveform from the input and the clipped part is based on the orientation of the diode and the DC voltage source connected to it.

3) **Diode clamping circuit:**
    - It is used to shift the wave either in upward or downward direction based on the orientation of the diode and the voltage source connected to it
    - If the output terminal of the diode is connected to the capacitor then the waveform shifts in the positive direction , and if the input terminal of the diode is connected to the capacitor then the waveform shifts towards negative direction.
    - If the positive terminal of the voltage source is connected to the ground then the waveform shifts in the negative direction , and if the negative terminal of the voltage source is connected to the ground then the waveform shifts in the positive direction.

Applications :

1) Half wave rectifier :
   - They are used in low power simple battery charger circuits
   - They are used in pulse generator circuits.
2) Diode clipping circuit:
   - They are used for the protection of transistors from transients
   - They can be used as voltage limiters and amplitude selectors
3) Diode clamping circuit:
   - They can be used as voltage doublers or voltage multipliers
   - They can be used for removing distortions.