# East West University

## Department of CSE

## Electrical Circuits Project

**Course Code: CSE251**

**Course Name: Electrical Circuits**


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**Section:** 04

**Group No: 07**

**Semester:** Spring 2023



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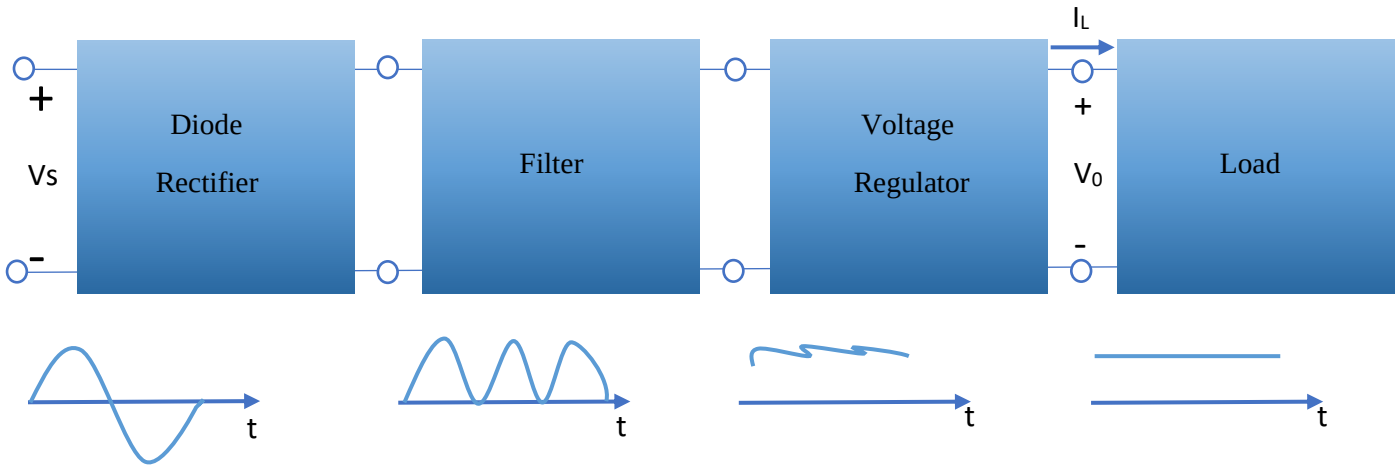
## **Project-2:** Design a 5V DC Power Supply using Diode for a specified input.



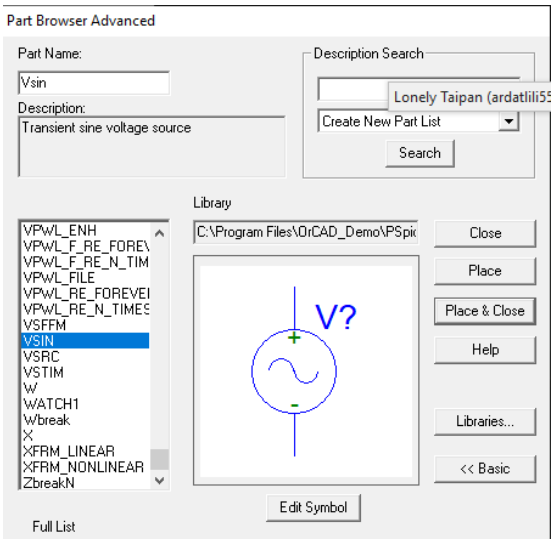

## Problem Statement:

Above figure gives a block diagram of a design of a DC power supply. It includes 3 design segments : a Diode rectifier, a Filter, and a Voltage regulator in order to obtain a final output of $V_0$. Diode rectifier converts the input sinusoid to a unipolar output as shown in the above figure. The variations in the magnitude of the rectifier output are considerably reduced by the filter block. The output of the rectifier filter contains a time dependent component, known as ripple. To reduce the ripple and to stabilize the magnitude of the dc output voltage against variations caused by changes in load current, a Zener shunt voltage regulator can be implemented. implemented. We will now design the circuit components, and simulate to test the circuit. We will use sine wave (24Vp-p) as input signal, a capacitor, 2 resistors and a Zener diode of suitable value for the design. Note that, for design purposes, the values of the resistors should not exceed more than 10kΩ.

# Design Details:

## Step 1: Identifying and designing of Voltage source

In order to obtain the sine wave, we need to use a Transient sine voltage source (VSIN) as input voltage. To obtain a smooth sine wave, we will be using $24V_{P-P}$ which means $V_{amp}$ = 12V and Frequency = 1kHz.



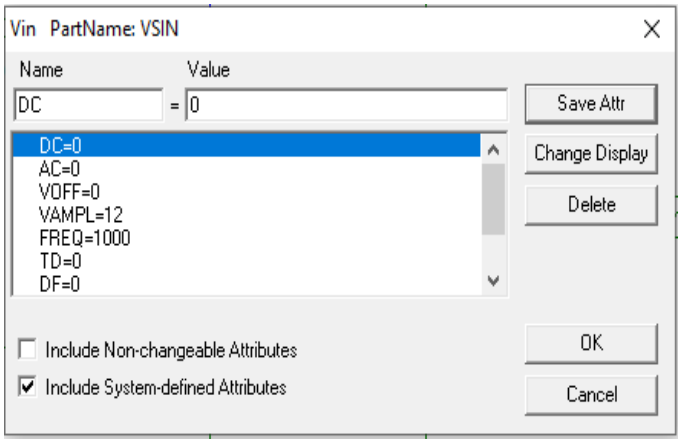




**Fig-1: Voltage Source -VSIN** **Fig-2: Values of VSIN**

Here for the transient source, we will be setting the following attributes:

1. Amplitude: 12 V
2. Frequency: 1KHz
3. DC: 0
4. AC: 0
5. Phase: 0

## Step 2: Identifying and designing of diode rectifier

To rectify the input sine wave, we have used bridge rectifiers as full wave rectifiers. For the rectifier, we have used 4 D1N4002 as diodes in the simulation.

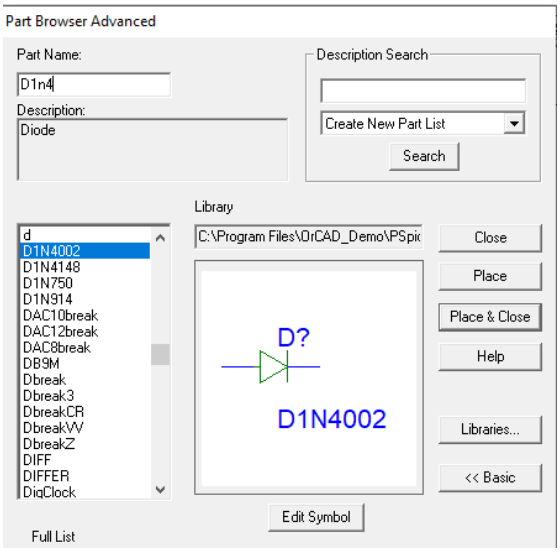


Fig-3: Diode - D1N4002

The bridge is composed of four diodes. During the positive half-cycle of input voltage $V_{in}$ the above terminal is at positive potential with respect to the below terminal and because of this diodes D1 and D2 are forward biased whereas diodes D3 and D4 are reverse biased (Fig: 4). The current therefore flows through diodes D1, D2 and load resistor RL. During the negative half-cycle of input voltage waveform, the diodes D3 and D4 are forward biased whereas the diodes D1 and D2 are reverse biased (Fig: 5). Consequently, current flows through diodes D3 and D4.

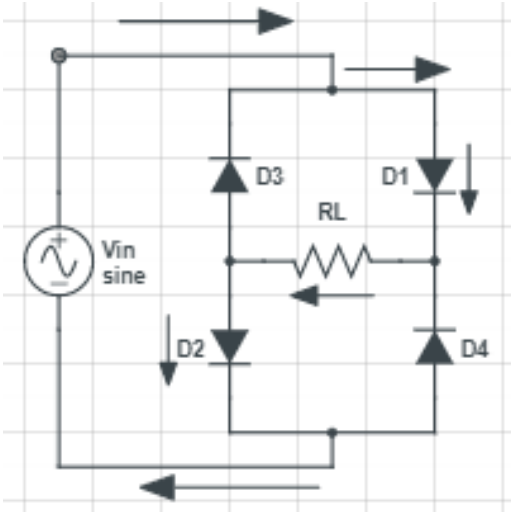


Fig-4: Positive Half Cycle

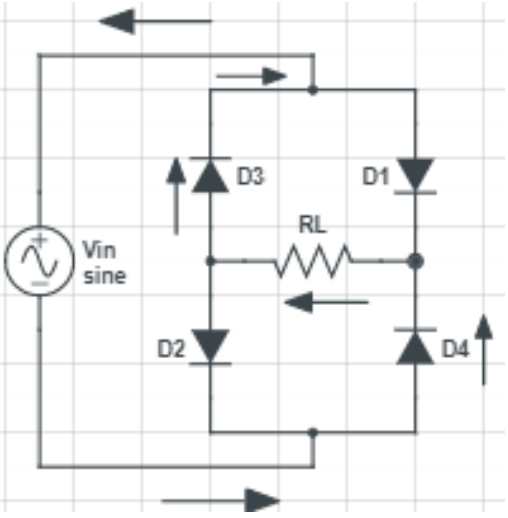


Fig-5: Negative Half Cycle

## Step 3: Identifying and designing of filter

To filter the rectified wave, we are using a capacitor which is placed parallel to the load resistor.
Here, Capacitor: 100µF and Load resistor :100Ω
AS a result, we get a ripple voltage wave.

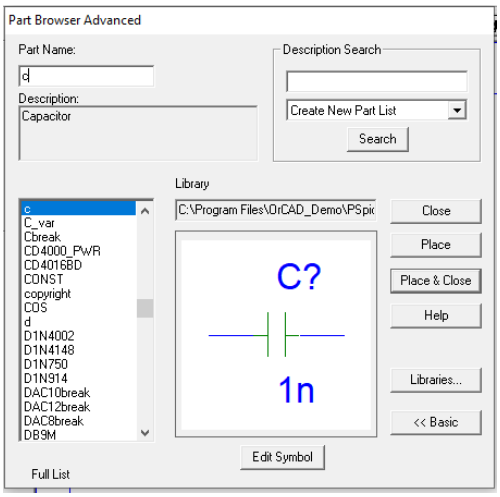



Fig-6: Capacitor

## Step 4: Identifying and designing of Voltage Regulator

To stabilize the ripple voltage and fixed the output voltage in 5V we have used a Zener Diode as a voltage regulator .

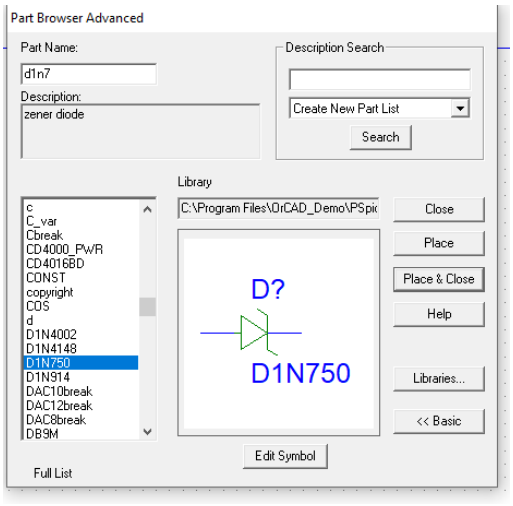



Fig-7: Zener Diode - D1N750

To fixed the output voltage at 5V,

1. Capacitor: 1mF or 1000µF
2. Load Resistor: 100Ω
3. Resistor in series with Zener diode: 5.5Ω

## Circuit Diagram:

The circuit diagram of the given project is given below:

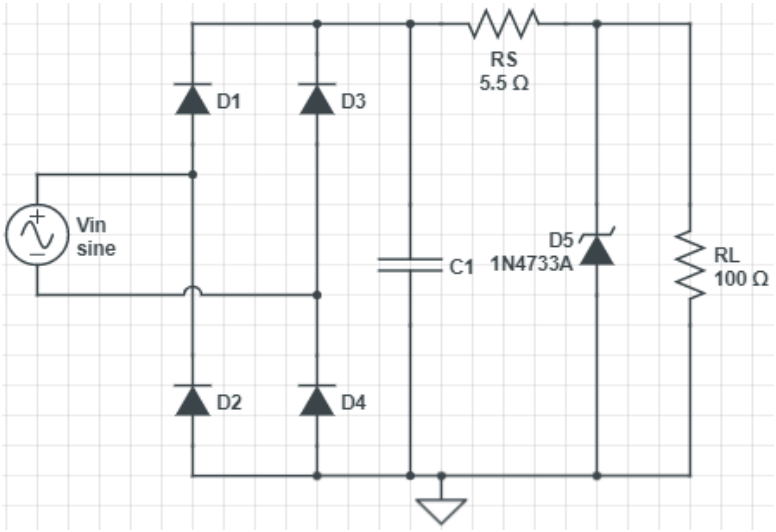



Fig-8: Rectifier Circuit with filter and voltage regulator

## Simulation Results:

### *Diode Rectifier circuit:*

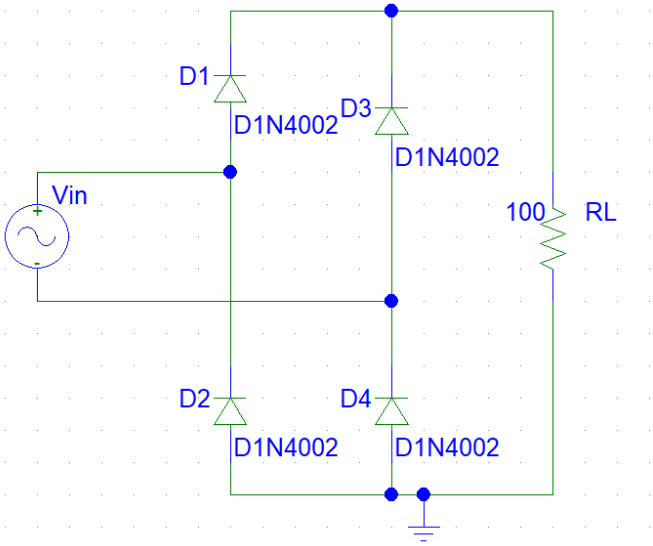
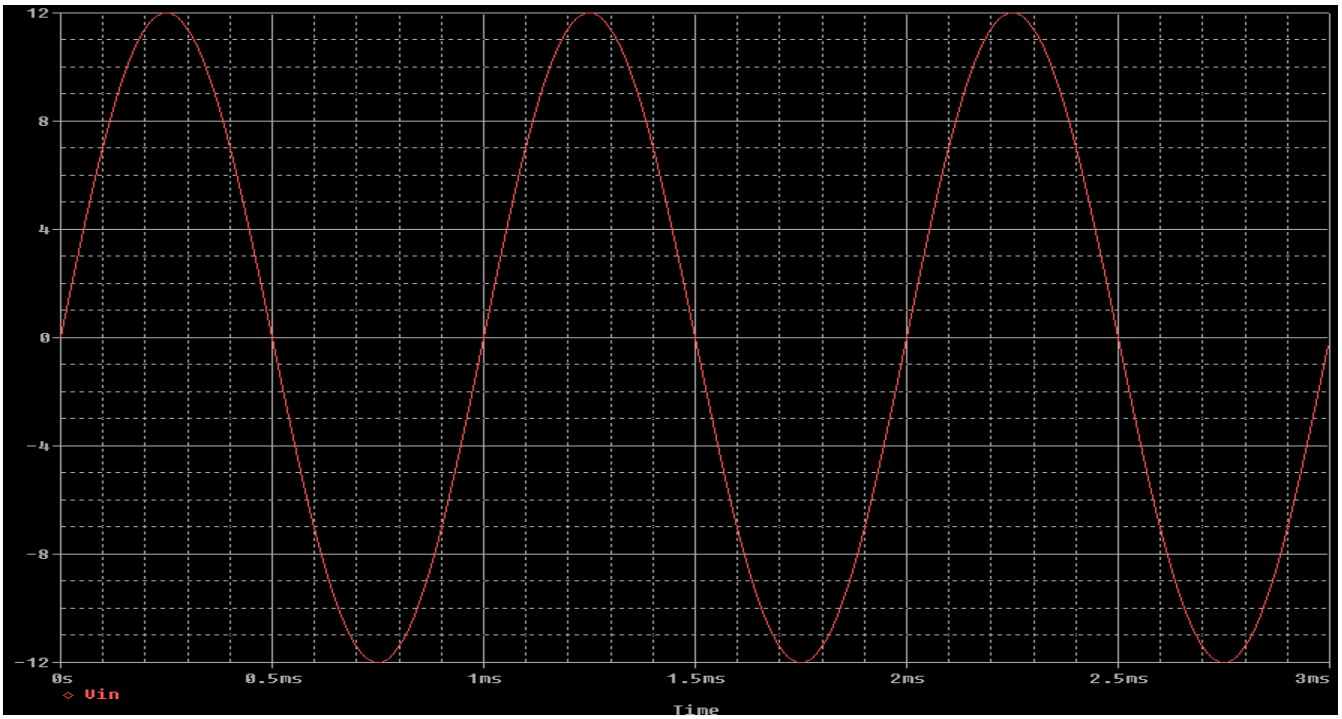
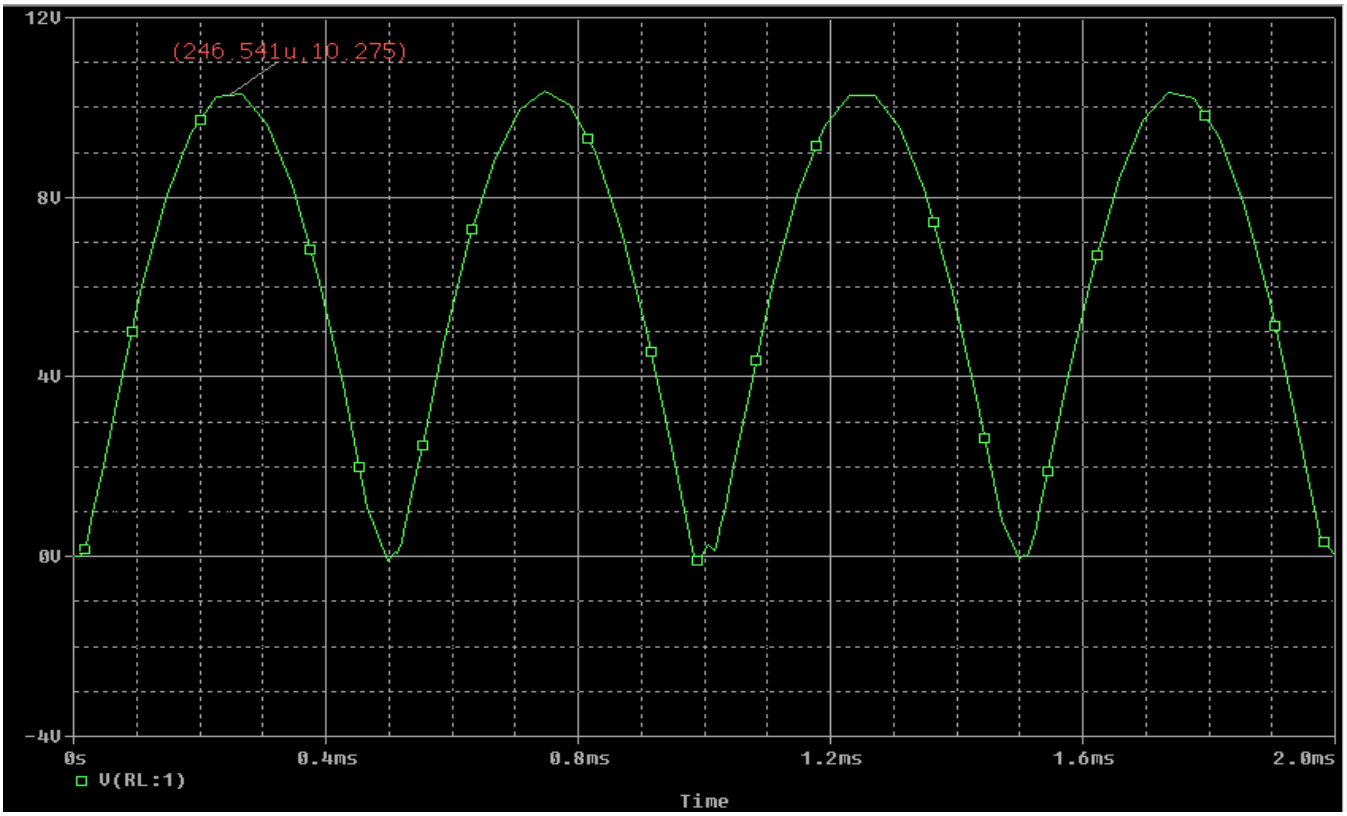



Fig-9: Rectifier Circuit




Plot-1: Input Wave




Plot-2: Output Wave after rectification

***Filter circuit:***

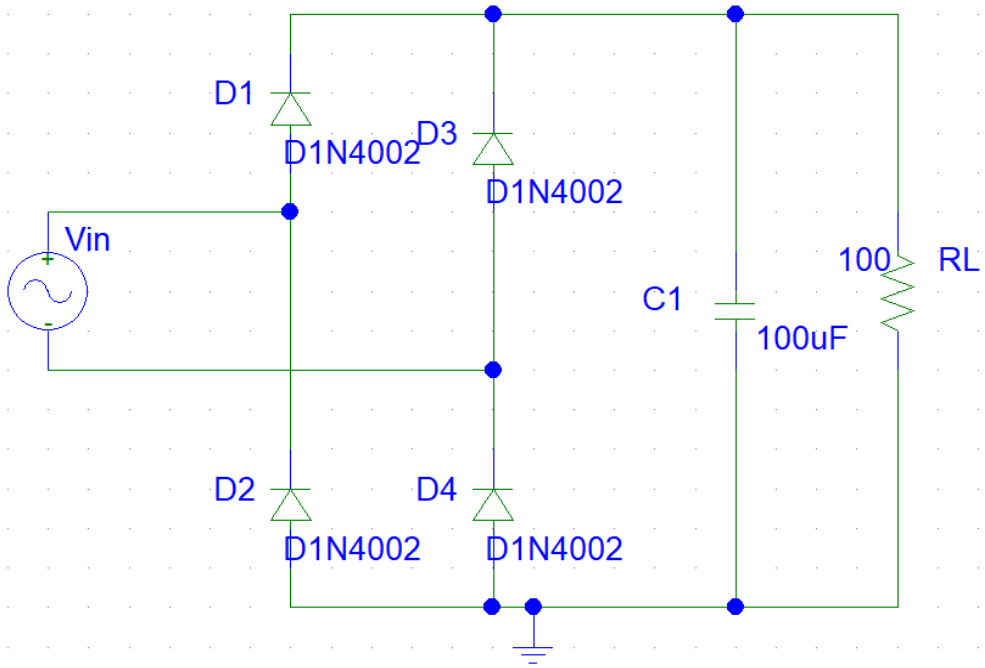
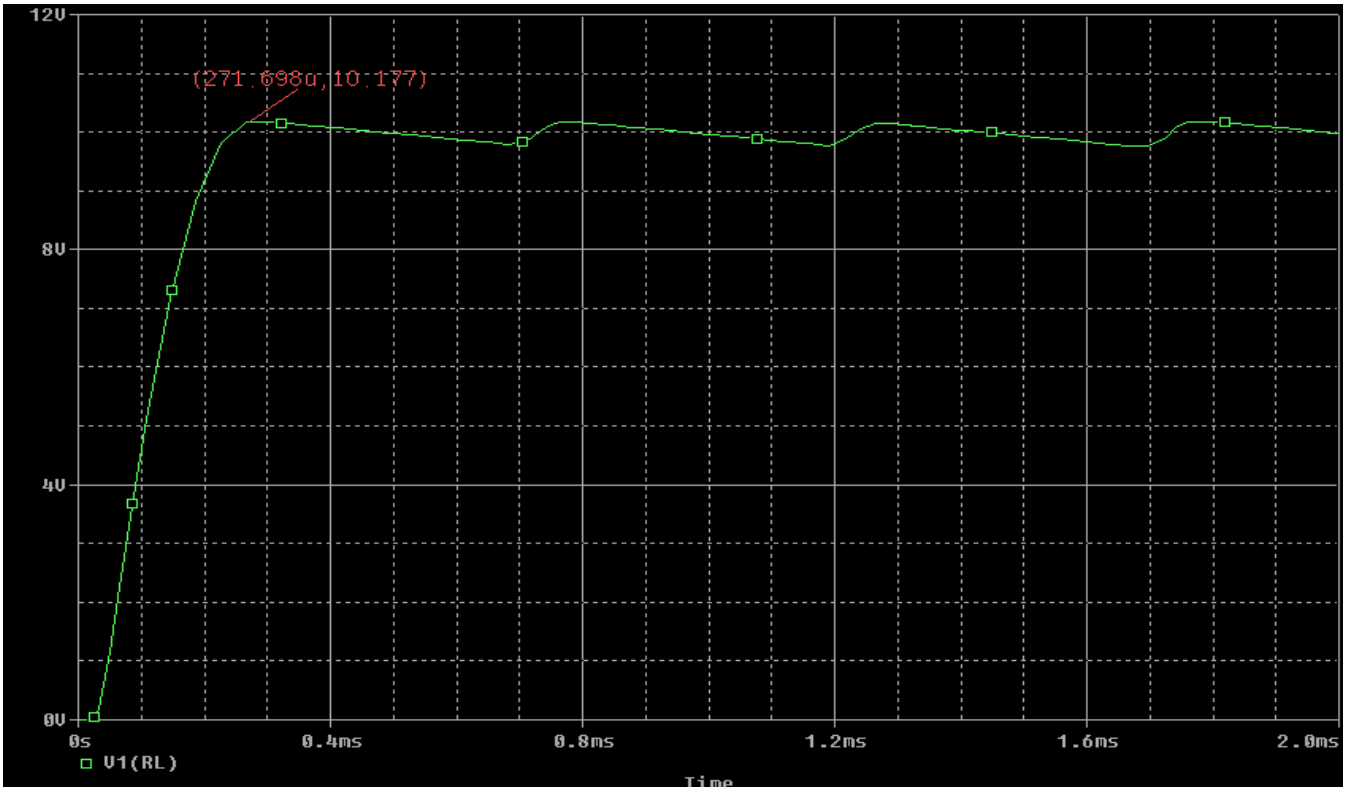



Fig-9: Rectifier Circuit with filter capacitor




Plot-3: Output Wave after filtration

***Voltage Regulator circuit:***

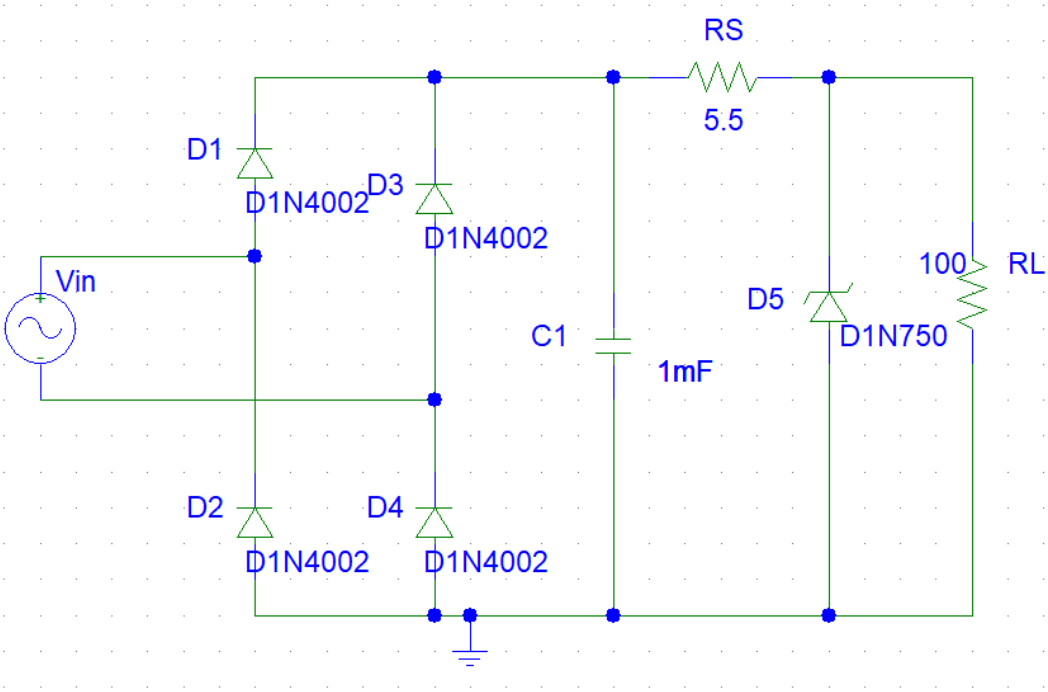
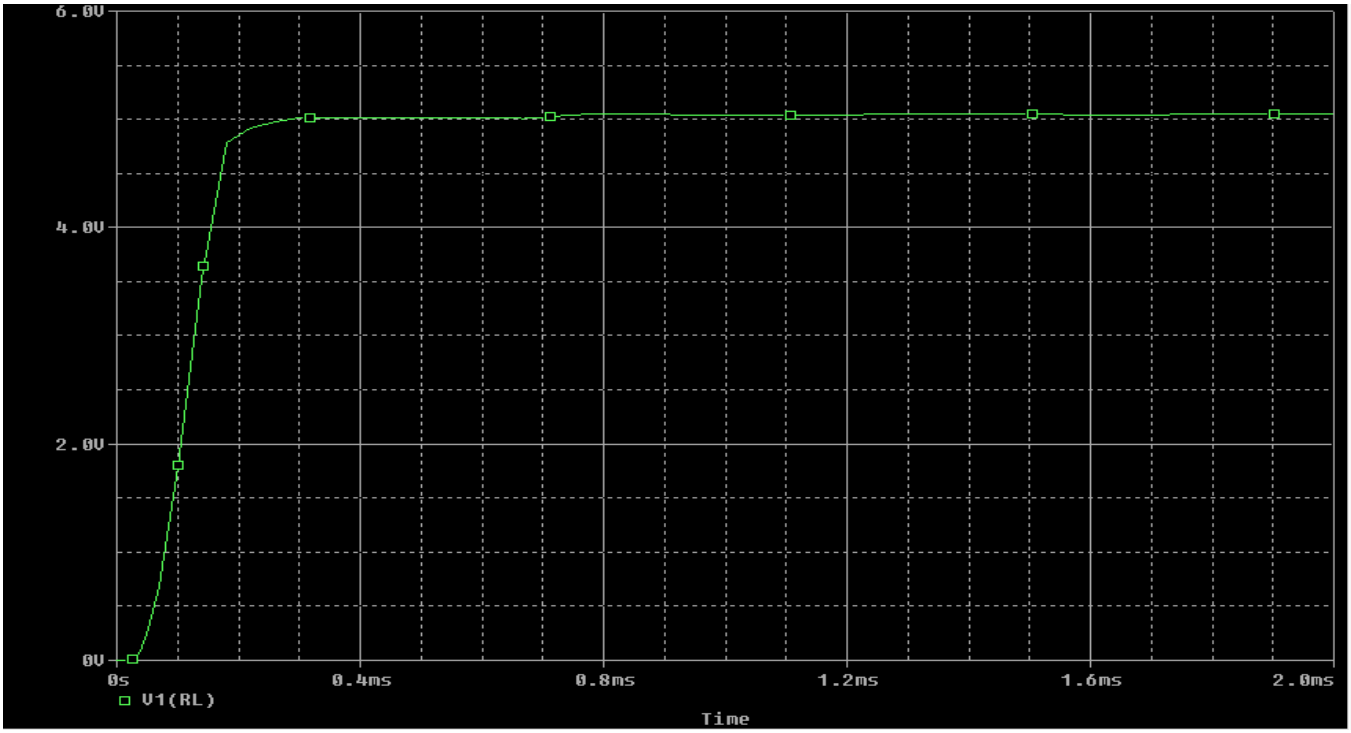



Fig-9: Rectifier Circuit with Voltage regulator




Plot-4: Output Wave after stabilizing at 5V

## Conclusion:

Due to no use of hardware, the values of the project has almost no discrepancy and less errors could have occurred. The circuits for diode rectifier, filter and voltage regulator are all simulated using PSpice showing how to stabilize a sinusoid's output to 5V.