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# **Design Project 1**

**ELECENG 2EI4**

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## Summary

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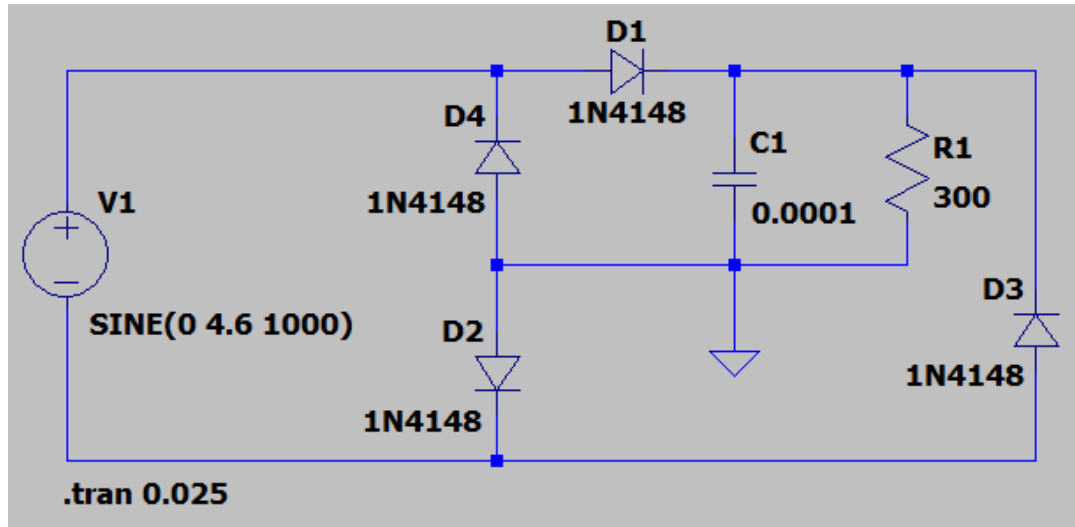
The objective of this design project is to create a DC power supply that only delivers a 10mA current at  $3V \pm 0.1V$  from a 120V source at 1kHz. To meet these requirements, a circuit was created on LTspice to run a simulation, and then a physical circuit was created to confirm the results from the simulation.

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## Design

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- I. The input voltage required for our design would be about 4.6V. This is because  $(2*0.7) + 3 = 4.4$  but the 4.4V does not yield a proper result and it drops over 1.4V, so it is increased little by little until 4.6 is reached, at which yields a more accurate result.
- II. A full-wave rectifier was utilized in this design, and it was created by placing 4 diodes, the resistor, and the capacitor in parallel.
- III. One 100uF capacitor was used as the filter in this design.
- IV. A regulator was not used in this design.
- V.



VI.

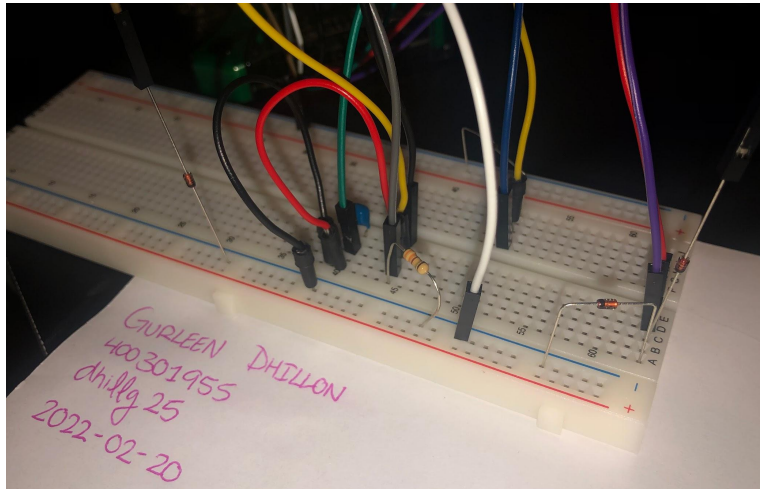
$$R_L = \frac{V_{drop}}{I_L} = \frac{3V}{10mA} = 300\Omega$$
$$V_{ripple} = \frac{(V_L + V_{drop}) - V_{drop}}{fCR_L} = \frac{3}{(1000)(0.1*2)(300)} = 50\mu F$$

- VII. According to these design calculations, it is expected that the output voltage would be within the error of 3V.
- VIII. For the design of this circuit, Zener diodes and center-tapped rectifiers were also considered, but they were less efficient than the ones that were used, therefore

eliminated as an option. Keeping yourself safe and the components safe when working with electronics is also a very important task when designing circuits. Before physically making circuits, it is always best to check if the circuit will damage any components using online simulator applications such as tinkercad, where u can build a circuit to see if it will function correctly. It is also important to keep yourself safe by wearing appropriate equipment as well as checking to see how much each component can handle.

## Measurement and Analysis

I.

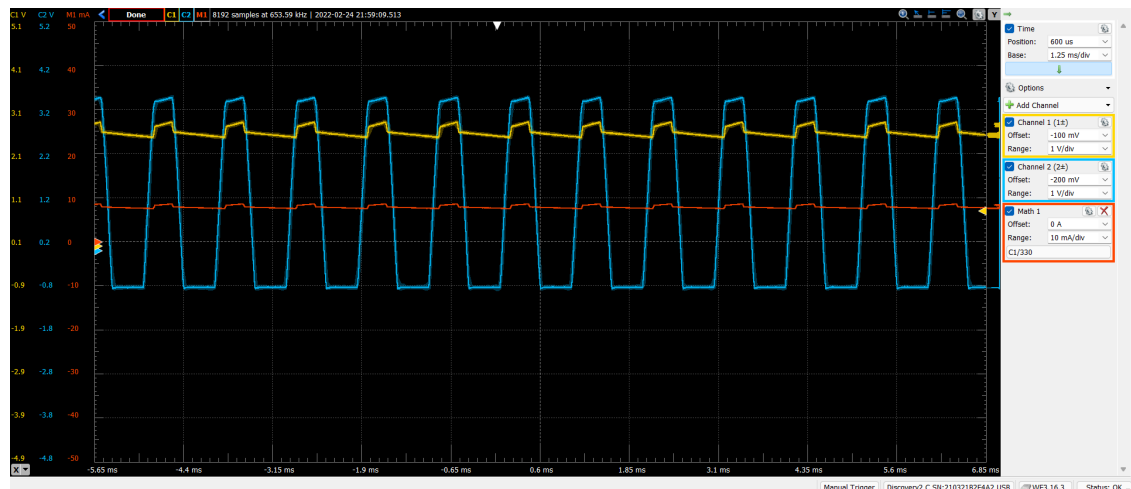


II. Channel 1 was connected to the points across the resistor to determine the output voltage. Channel 2 was connected to the input voltage and ground to compare the 2 voltages. Math 1 was used to calculate the current across the resistor.

III.

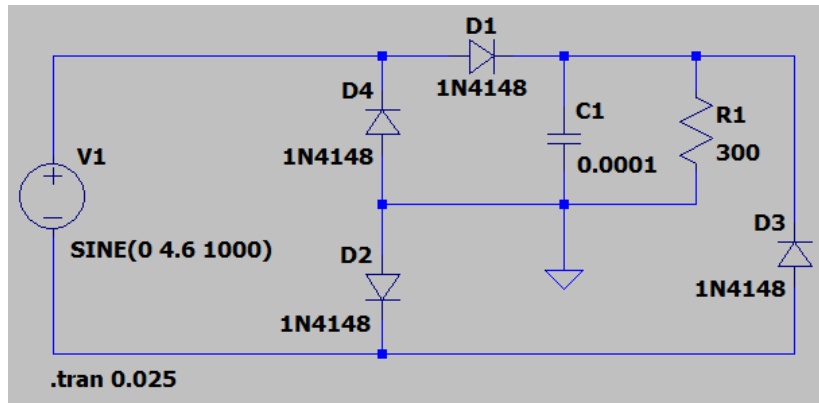
	C2	C1	M1
Max	3.5137 V	2.9567 V	8.6701 mA
Min	-0.8776 V	2.7531 V	7.9533 mA
Avg	0.7565 V	2.8549 V	8.3117 mA

IV.



## Simulation

I.

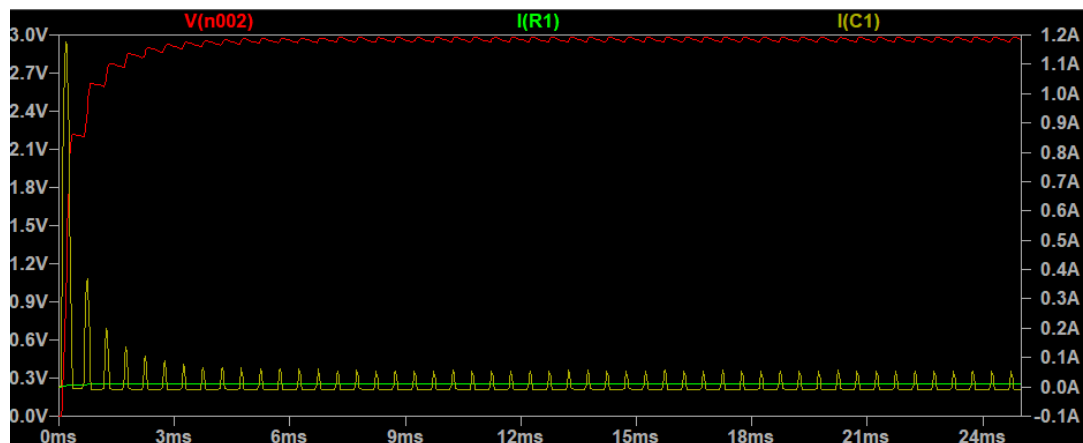


II.

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* C:\Users\gurle\OneDrive\Documents\LTspiceXVII\eleceng 2ei4\Draft1.asc
V1 N001 N003 SINE(0 4.6 1000)
D1 N001 N002 1N4148
D2 0 N003 1N4148
D3 N003 N002 1N4148
D4 0 N001 1N4148
R1 N002 0 300
C1 N002 0 0.0001
.model D D
.lib C:\Users\gurle\OneDrive\Documents\LTspiceXVII\lib\cmp\standard.dio
.tran 0.025
.backanno
.end
```

III. The type of simulation used for this circuit was transient. For the simulation, a stop time of 0.025s was used.

IV.





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## Discussion

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- I. The results from the design, simulation, and measurement are very similar to one another and almost fall within the same range.
- II. The results from the measurement section are the only ones that are slightly different from the design and simulation sections. This could be due to the errors caused from the components in real life which are not a factor of consideration in simulations and calculations.
- III. Some of the limitations of this design include not being able to output a voltage larger than 3V as in the measurements section, a higher voltage was unachievable.
- IV. Many problems arose in the measurements section, including faulty scales/ranges, misplaced nodes on the breadboard, etcetera. All these issues had to be fixed using trial and error.