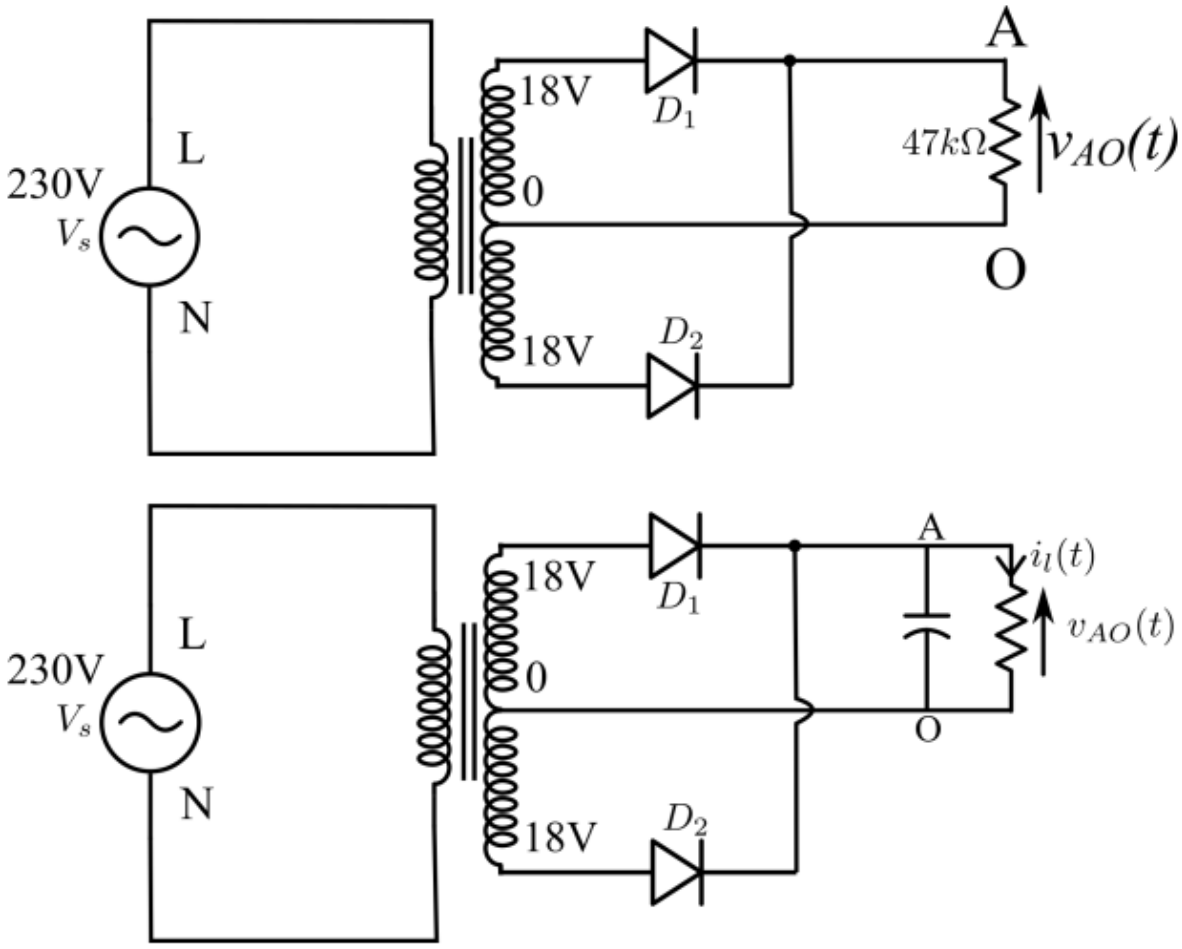
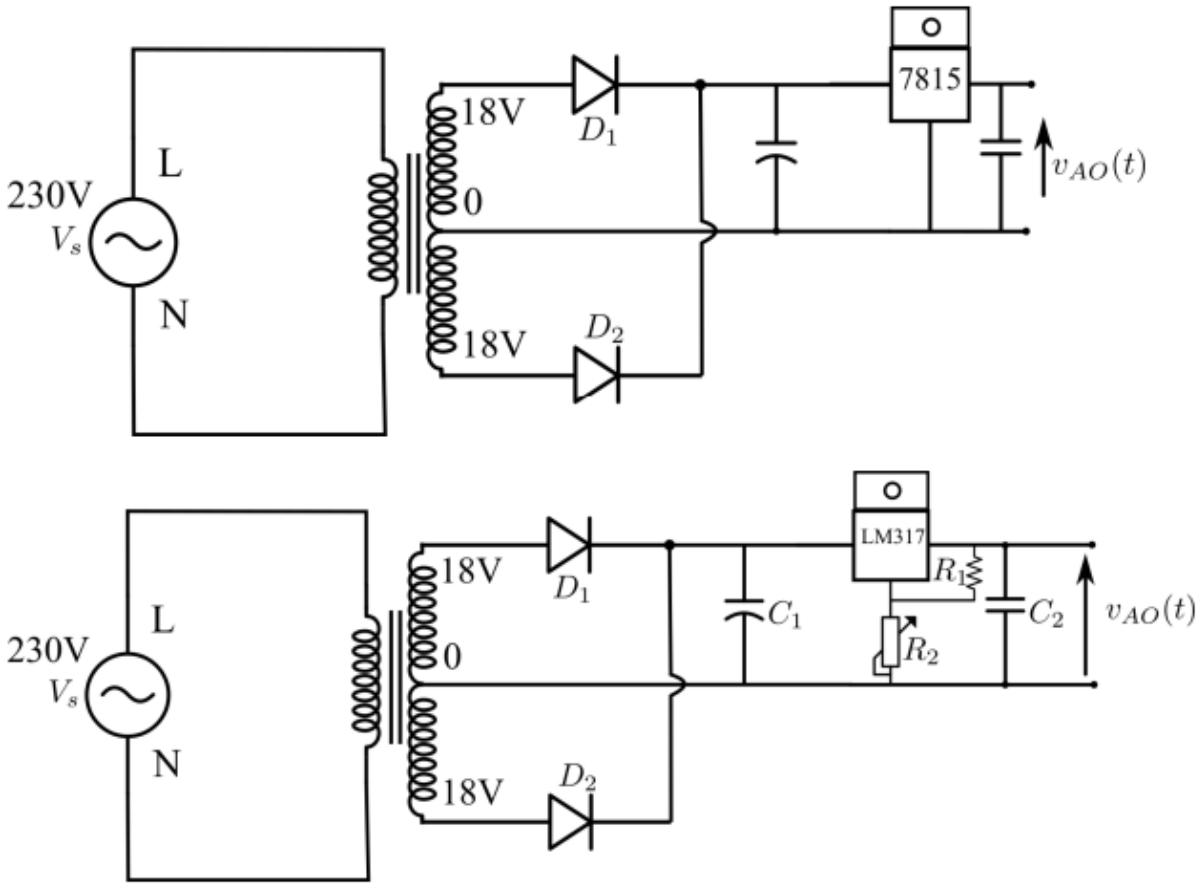
EE 311: Electrical Machines and Power Electronics Laboratory
LAB REPORT - 1

EXPERIMENT 1 : Design an uncontrolled rectifier for given specifications.

AIM - Design a power supply using an uncontrolled rectifier and then add a linear regulator and observe the output waveforms.

Circuit Diagram / Experimental Setup :



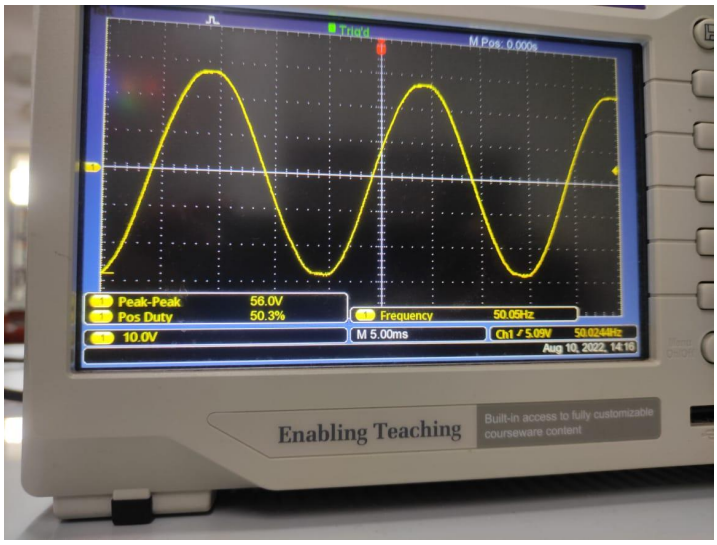


Procedure / Steps:

1. Connect the center tapped transformer to a single phase 230V power supply.
2. Solder the output terminals of the transformer to the diodes as shown in the figure.
3. Design the capacitor for given ripple voltage specification(4V). .
4. Measure the output voltage and regulate its value using 7815, LM317 regulators.

Data recorded & measured:

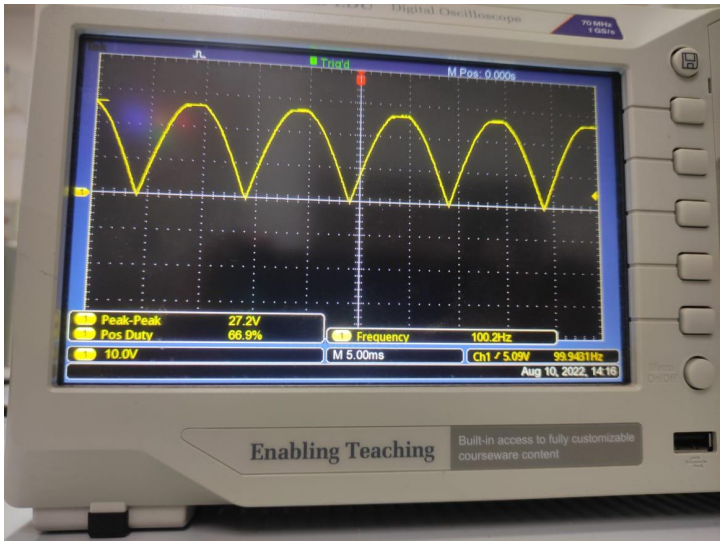
1. Transformer Secondary side Voltage waveform.



We got $V_{peak\text{-}peak}$ = 56 Volts, and we have 230 V_{rms} at the primary side and 18 V_{rms} at secondary side, so this should be approximately equal to 36√2 ~ 51 V.

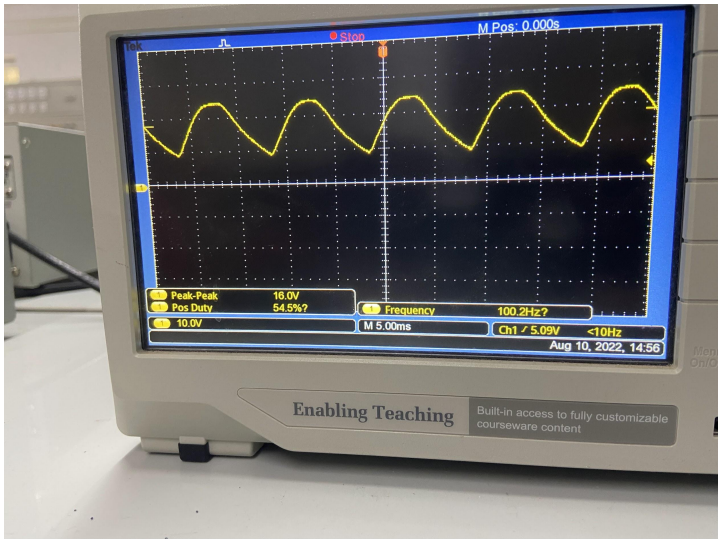
Since the mains voltage keeps on fluctuating, we get slight distortions from the desired value, as we got 56 V instead of ~51 V.

2. V_{out} after connecting the diodes for rectification.



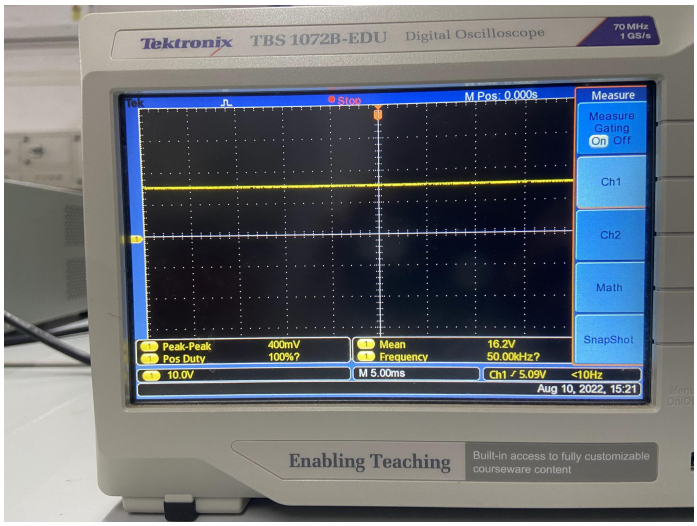
The voltage after rectification is, $V_{peak\text{-}peak}$ = 27.2 V which is close to 56/2 = 28 V.

3. V_{out} after connecting the load and capacitor.



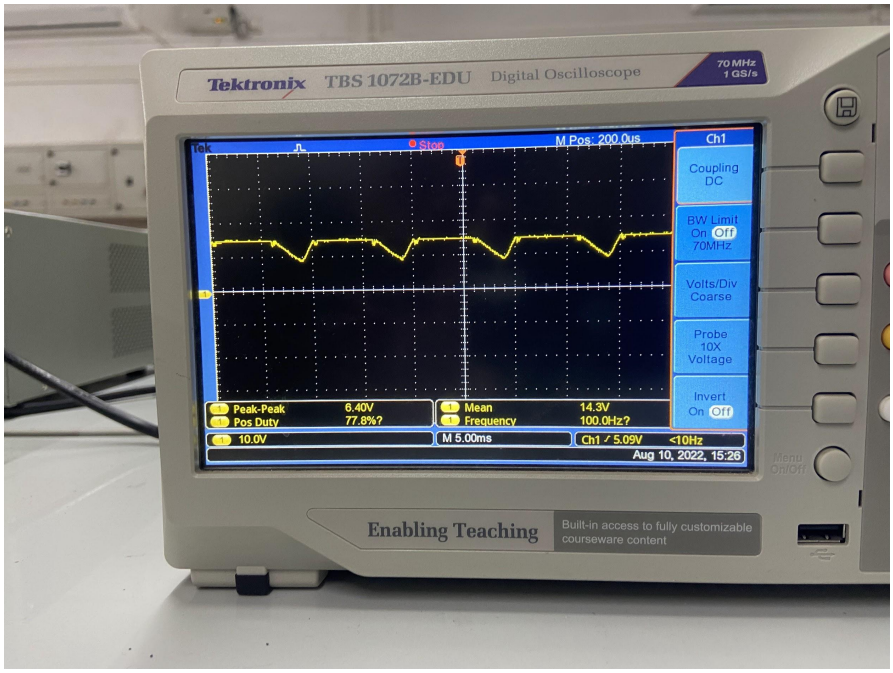
We can see the significant charging and discharging cycles after connecting the load and capacitor.

4. V_{out} after connecting 7815 regulator

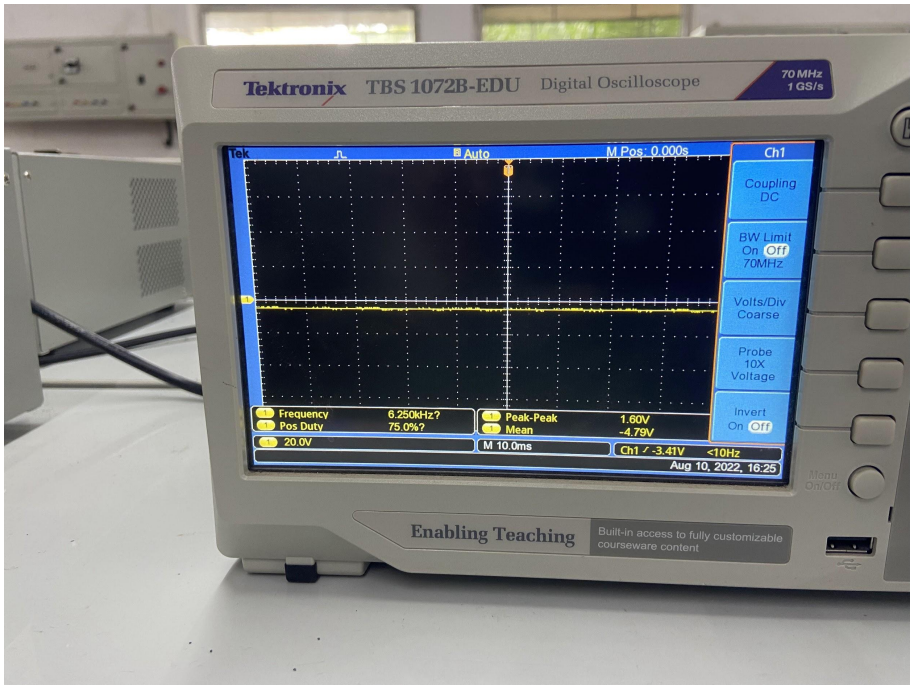


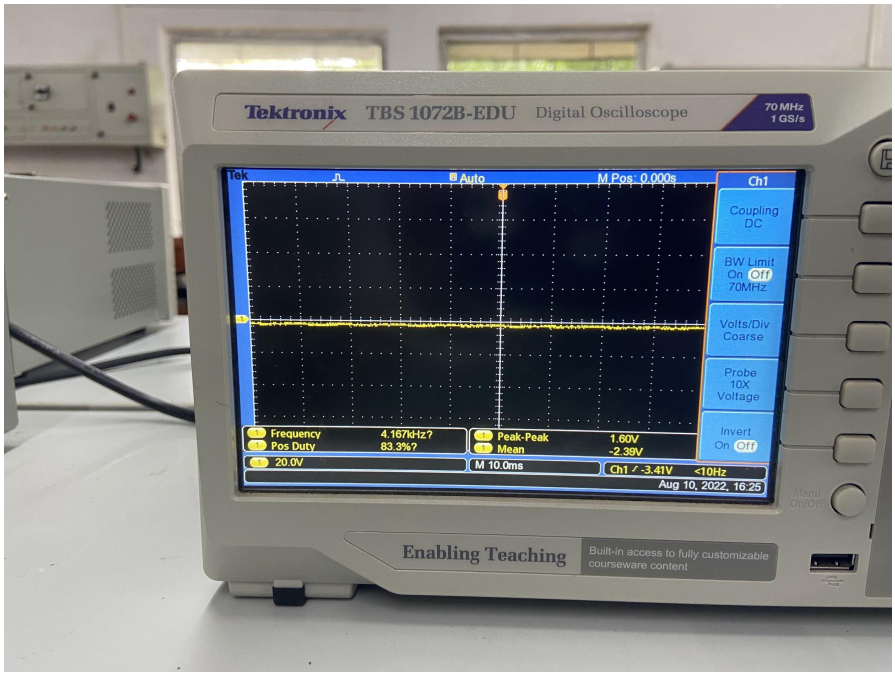
We get DC voltage of ~16.2 V after connecting to the 7815 regulator, which has a very low $V_{peak\text{-}peak}$ = 400 mV.

5. After loading the output terminals with 50 Ω resistor, the Output Voltage waveform.



6. V_{out} after connecting LM 317 regulator

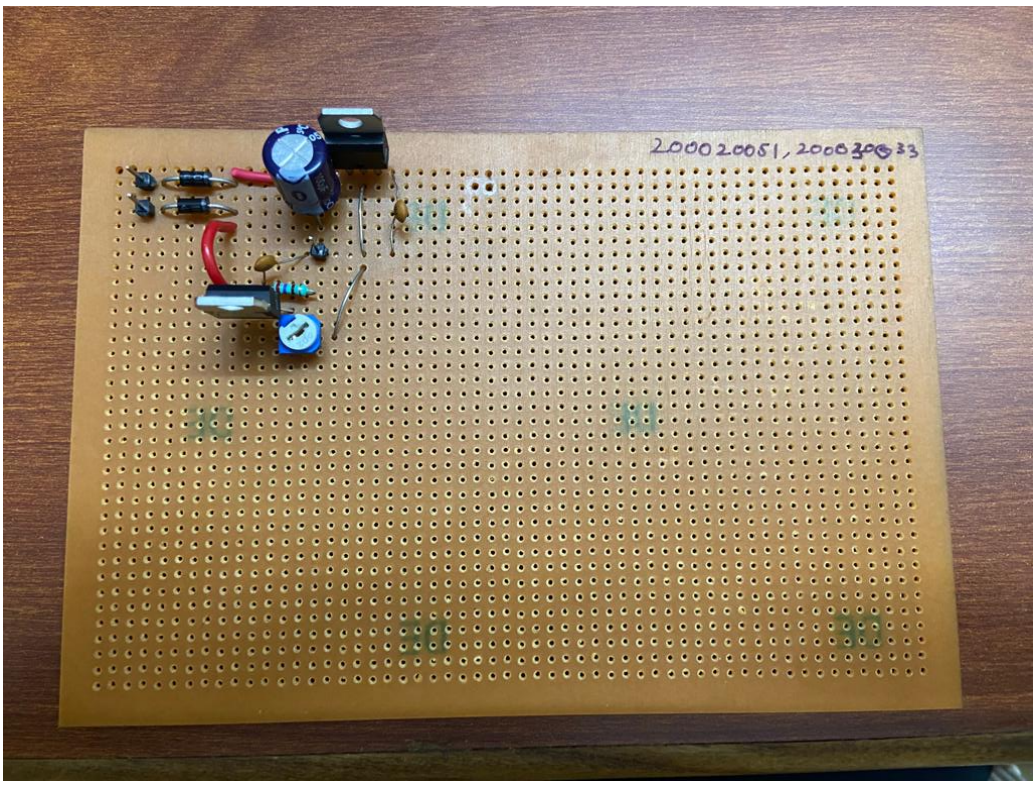




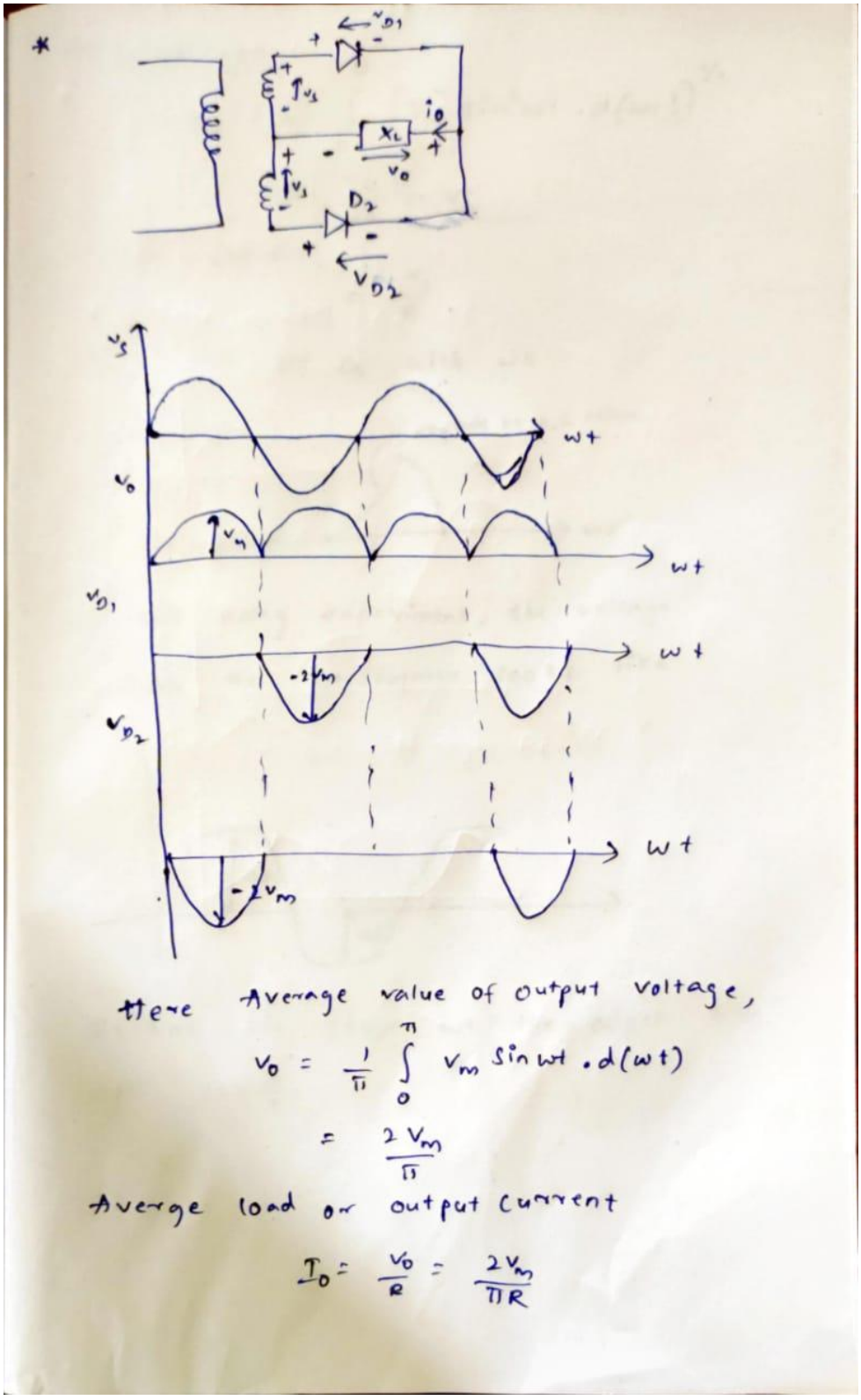
We took the LM 317 regulator and soldered the circuit and then we connected the circuit to the 18 V_{rms} and then changed the knob of potentiometer and observed change in the V_{out} of the circuit.

Hence we can control the output DC voltage of the circuit using this regulator, but the ripple is fairly higher than the 7815 regulator, from 400 mV to 1.6 V.

Soldered Board Snapshot:



ADDITIONAL RESULTS:



Here Average value of output voltage,

$$V_0 = \frac{1}{\pi} \int_0^{\pi} V_m \sin \omega t \cdot d(\omega t)$$

$$= \frac{2V_m}{\pi}$$

Average load or output current

$$I_0 = \frac{V_0}{R} = \frac{2V_m}{\pi R}$$

Rms voltage,

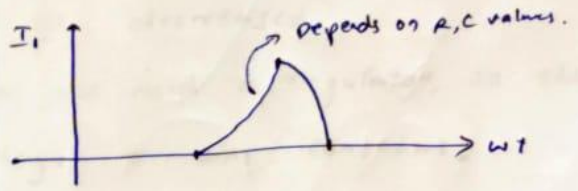
$$V_{or} = \frac{1}{\pi} \int_0^{\pi} \left[V_m^2 \sin^2 \omega t \cdot d(\omega t) \right]^{1/2}$$

$$= \frac{V_m}{\sqrt{2}} = V_s$$

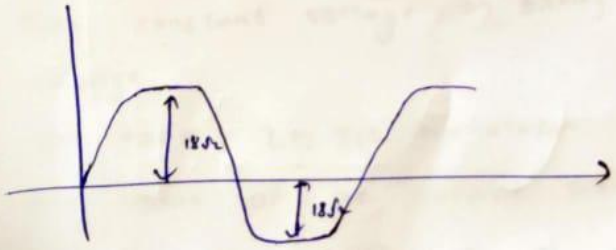
Rms current,

$$I_{or} = \frac{V_s}{R}$$

* current of D_1 with wt



* While doing experiment, the voltage from the transformer looks like



It has sin shape, but the edges are not sharp.

Analysis:

* Analysis:

1. When we kept a large resistance then the voltage is the sin wave.
2. Then we added capacitor to it, we found that the ripple is very large.
3. We removed the resistance and replaced with small resistance, then the ripple voltage decreased.
4. Now we need a regulator, so that the voltage remains constant.
5. We took LM7815 regulator and it gave us the constant DC voltage.
6. The C_{Load} made the small distortions into constant voltage, by taking them as charge.
7. We took LM 317 regulator TO change the value of DC output voltage, by changing the resistance of Pot.