Analog Electronic Circuits – Lab 3

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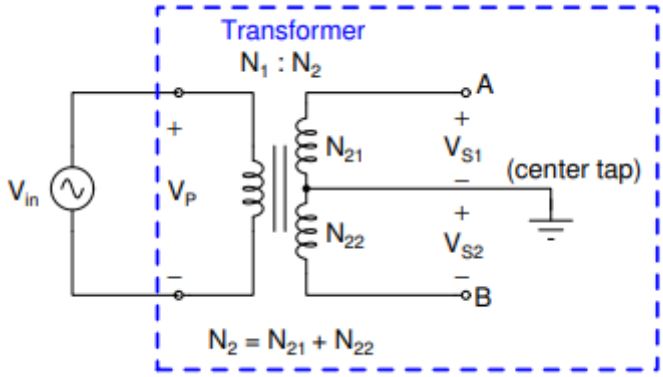
Experiment 1:

- Objective:

  To analyse the working of a transformer and measure its turns ratio.

- Circuit Diagram:



- Procedure:

  1. Apply a sinusoidal voltage of amplitude 12V and frequency 1kHz in V_{in}.
  2. Measure the amplitudes of V_{S1} and V_{S2} and use it to calculate N_1:N_2, using the formula,

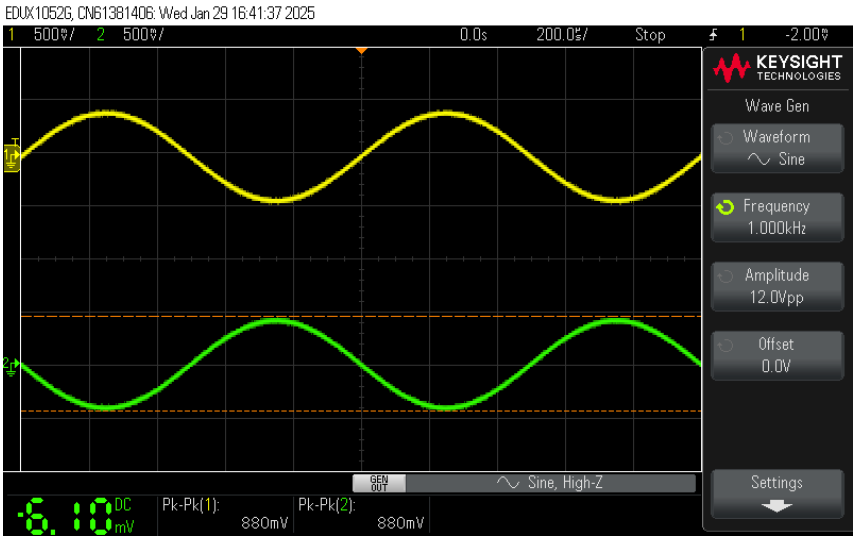
  $$\frac{N_1}{N_2} = \frac{V_{in}}{V_{S1} + V_{S2}}$$

  Where the voltage terms represent the amplitude of those voltage responses.

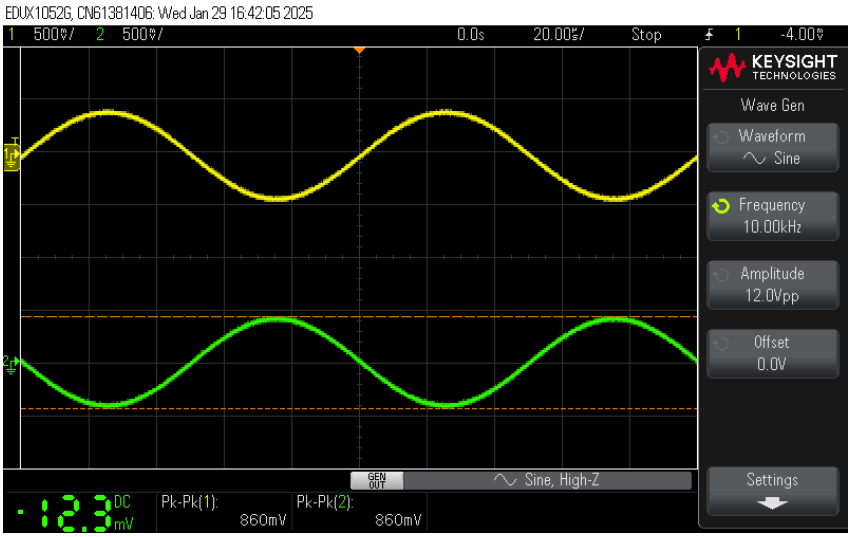
  3. Repeat for higher frequencies and tabulate the values.
  4. Find the Bode Plot of the circuit in the DSO and find the -3db bandwidth.

- Observations:

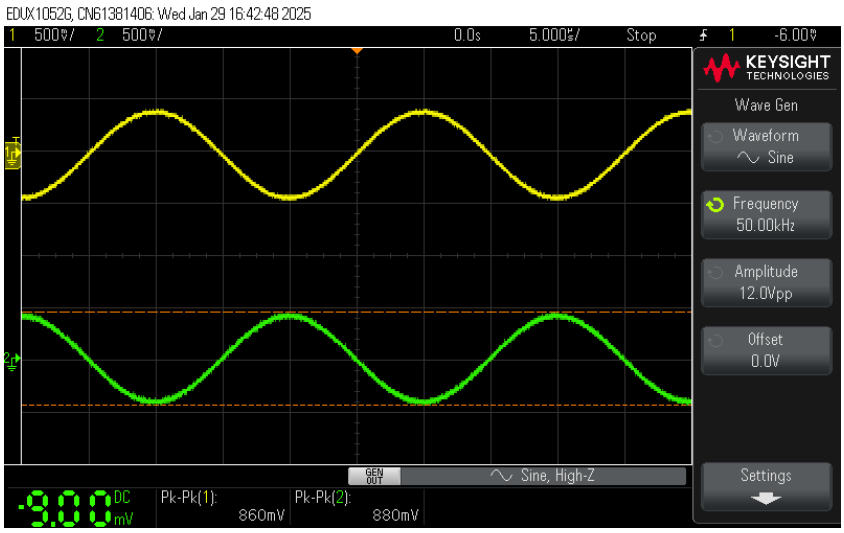
S.no	Freq(kHz)	Amplitude(V)	V_a (V)	V_b (V)	N_1/N_2
1.	1	12	0.88	0.88	6.818182
2.	10	12	0.86	0.86	6.976744
3.	50	12	0.86	0.88	6.896552
4.	100	12	0.9	0.9	6.666667
5.	1000	12	2.61	1.27	3.092784
6.	5000	12	0.65	1.51	5.555556
7.	10000	12	0.047	0.278	36.92308
8.	20000	12	0.119	0.074	62.17617



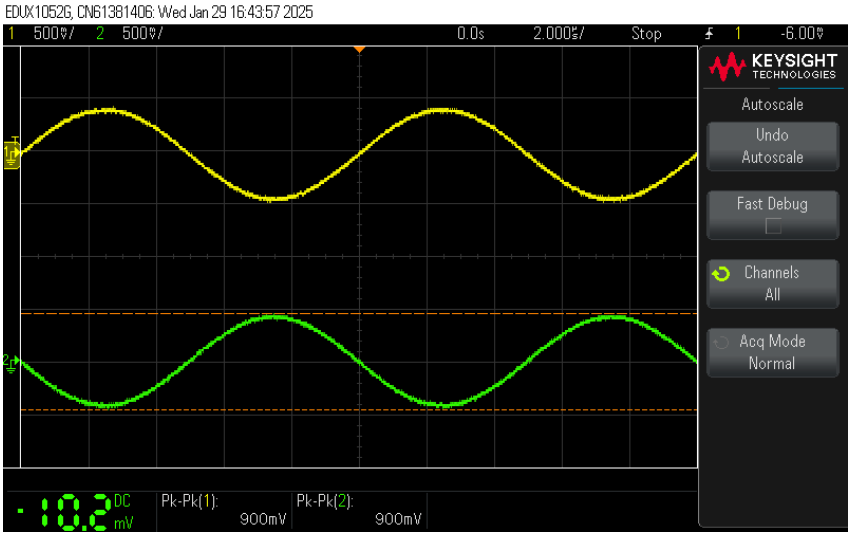
Measurement 1



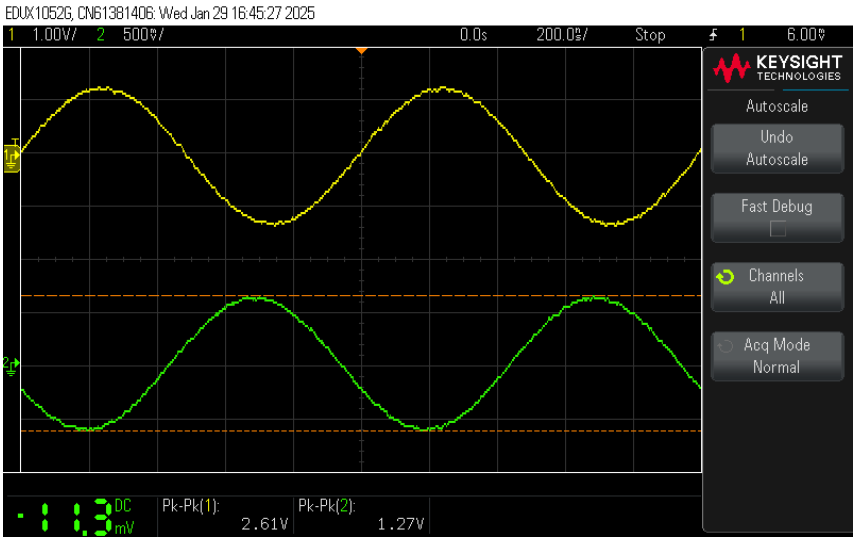
Measurement 2



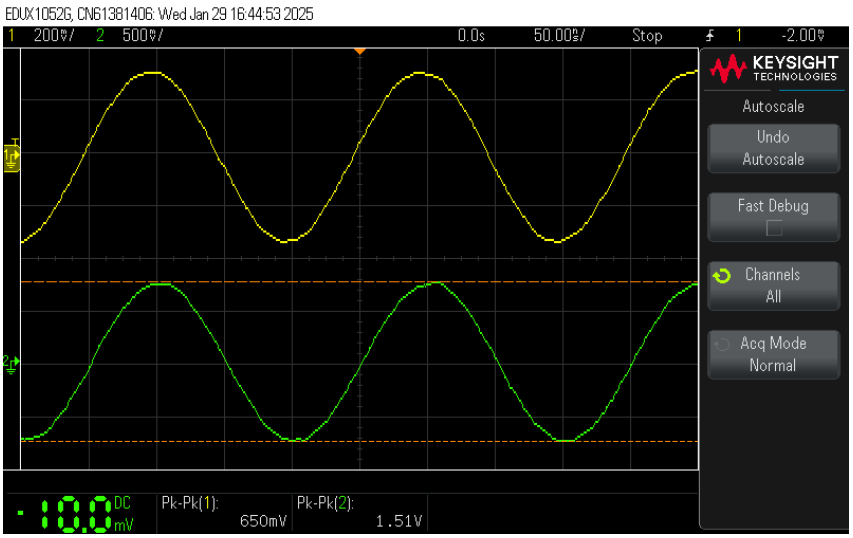
Measurement 3



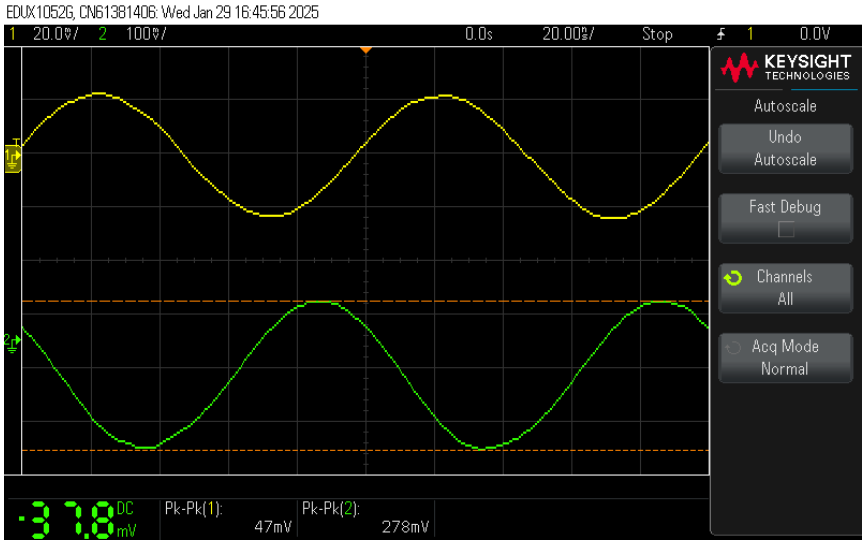
Measurement 4



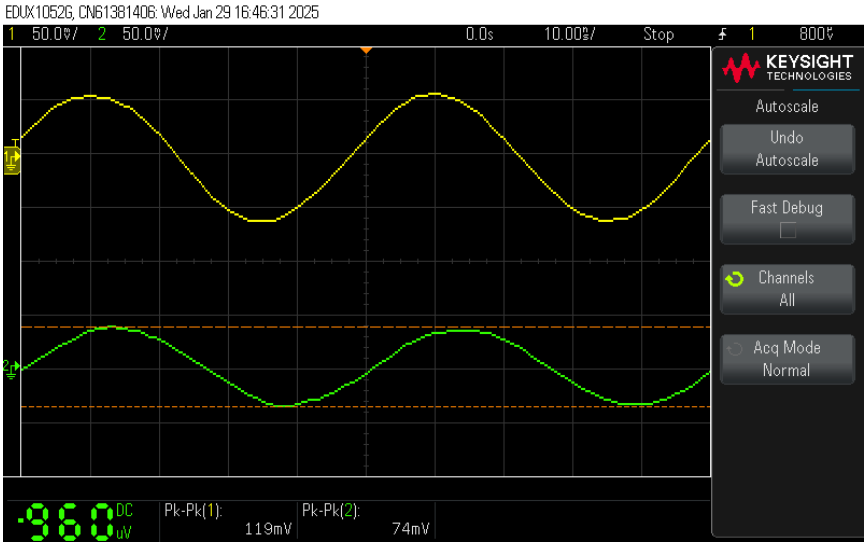
Measurement 5



Measurement 6

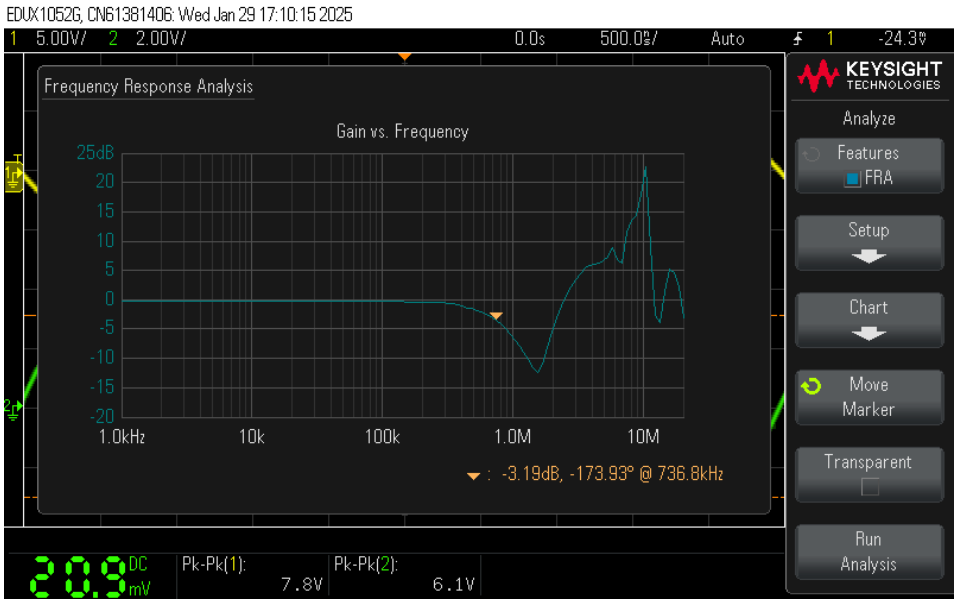


Measurement 7



Measurement 8

-3db Value: 736.8 kHz



- Result:

The working of a transformer was observed.

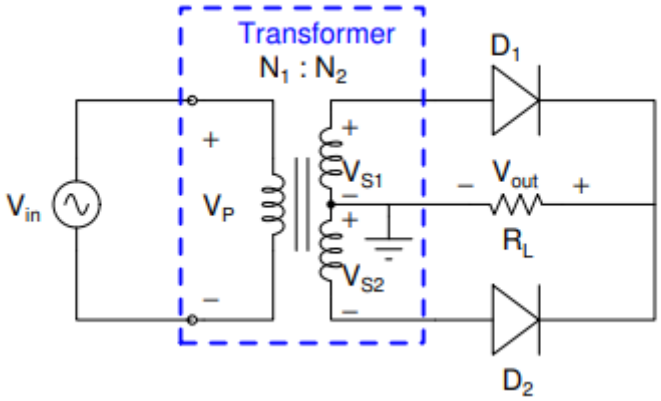
1. The output sinusoid is out of phase from the input sinusoid by 180º.
2. The readings in red are where the transient behaviour of the transformers is dominant and there is significant deviation from ideal behaviour, due to the high frequency.
3. There is also significant reduction in amplitude in the high frequencies due to them exceeding the bandwidth of the wire.

Experiment 2:

- ## Objective:

  To observe the working of a full wave rectifier.

- ## Circuit Diagram:



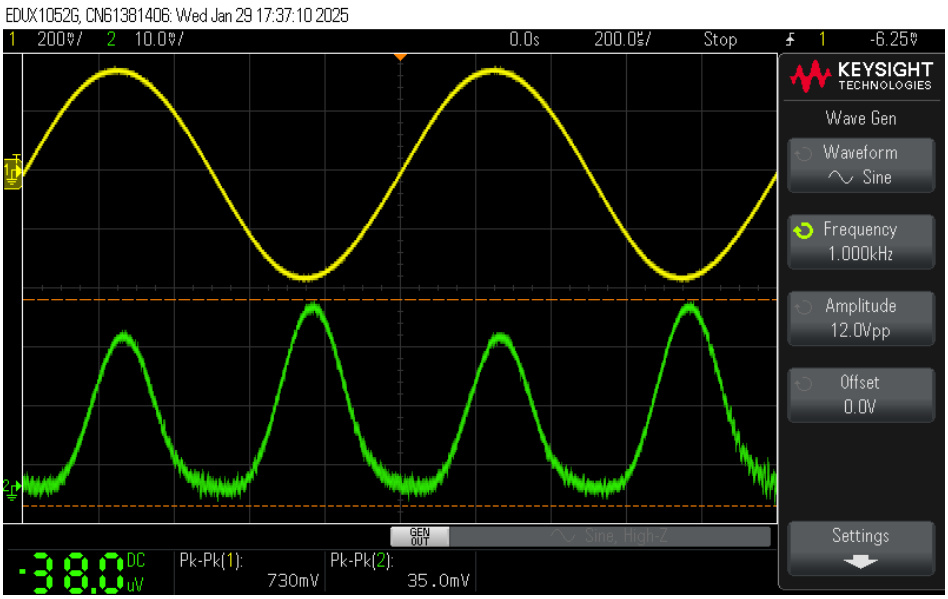
- ## Procedure:

  1. Apply a sinusoid of 12V amplitude and 1kHz frequency. Take R_L as 50 kΩ.
  2. Plot V_{S1} and V_{out} and observe the output response.
  3. Measure the peak current flowing through I_L, using the formula,

$$I_L = \frac{V_{out}}{R_L}$$

- ## Observation:

Amplitude(V)	Freq(kHz)	V_{S1} (V)	V_{out} (V)	I_L (µA)	R_L (Ω)
12	1	0.73	0.035	0.7	47kΩ



Observation

- Result:

  The behaviour of a full wave rectifier has been observed.

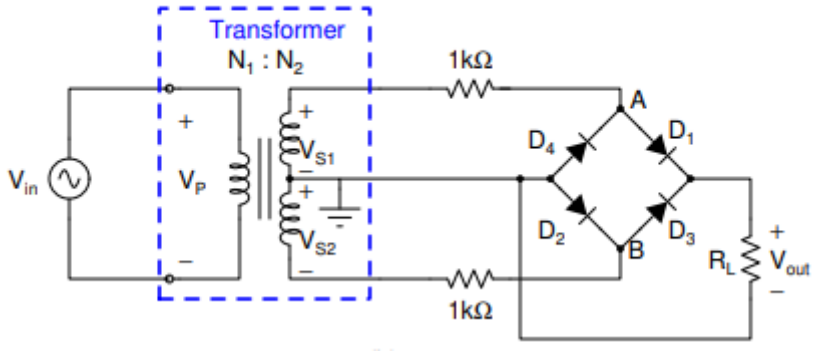
  The amplitude of the final output wave is low because of the low output voltage, since the diode cannot conduct fully at that voltage.

Experiment 3:

- ## Observation:

  To observe the behaviour of a bridge rectifier.

- ## Circuit Diagram:

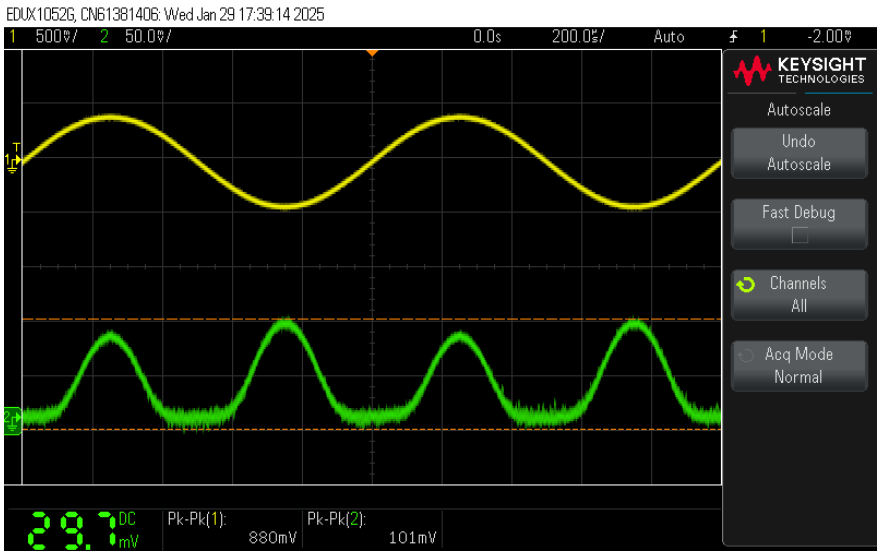


- ## Procedure:

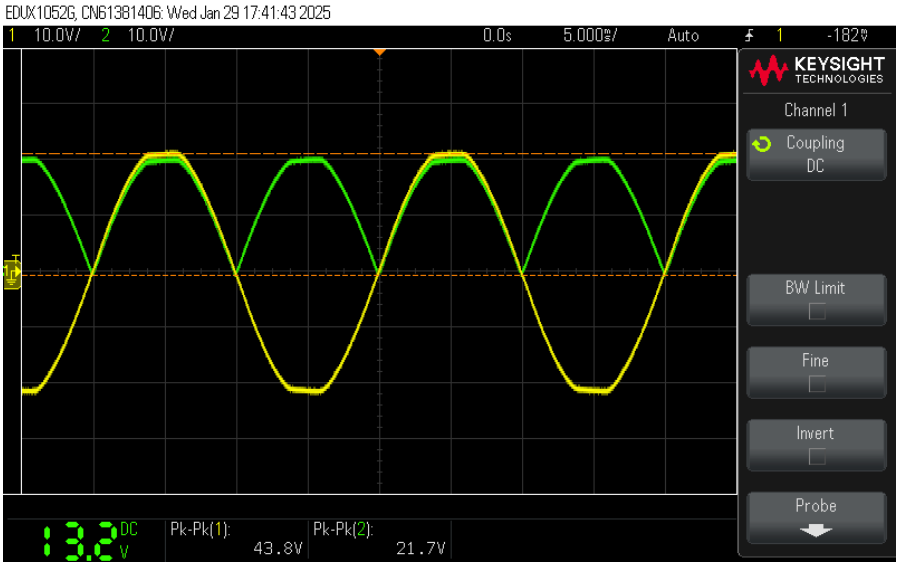
  1. Apply a sinusoidal voltage of amplitude 12V and frequency 1kHz and keep R_L = 50kΩ.
  2. Repeat steps 2 and 3 of the previous experiment.
  3. Replace V_{in} with the wall supply and repeat steps 2 and 3 of the previous experiment.

- ## Observation:

V_{in} (V)	Freq (Hz)	V_{s1} (V)	V_{out} (V)	R_L (kΩ)	I_L (μA)
12	1000	0.88	0.101	50	2.02
220	50	43.8	21.3	50	426



Measurement using 12V supply



Measurement using Wall Supply

- Result:

  The working of a bridge rectifier has been observed.

  The output from the wall supply is more similar to V_{S1} than the 12V supply, since the diode does not fully conduct at low voltages, which is the case for the diode.