Experiment No.4

Full-Wave Bridge Rectifier

1. Objectives:

- Construct the full-wave bridge rectifier circuit.
- Measure/plot the input and output waveform.
- Find the peak and average values of the output signal
- Define the turns ratio *n* of the transformer.

2. Components and equipment

- A standard transformer
- A two-channel Oscilloscope.
- Multimeter
- Breadboard, four semiconductor Diodes, and a 1KΩ Resistor.

3. Theory

The circuit of a full wave bridge rectifier uses four diodes D_1, D_2, D_3 and D_4 connected as shown in Fig. 1. During the positive half cycle of secondary voltage, the diodes D_1 and D_2 are forward-biased, and D_3 and D_4 are reverse-biased. Therefore, the diodes D_1 and D_2 conduct, and current flow through load resistor R_L.

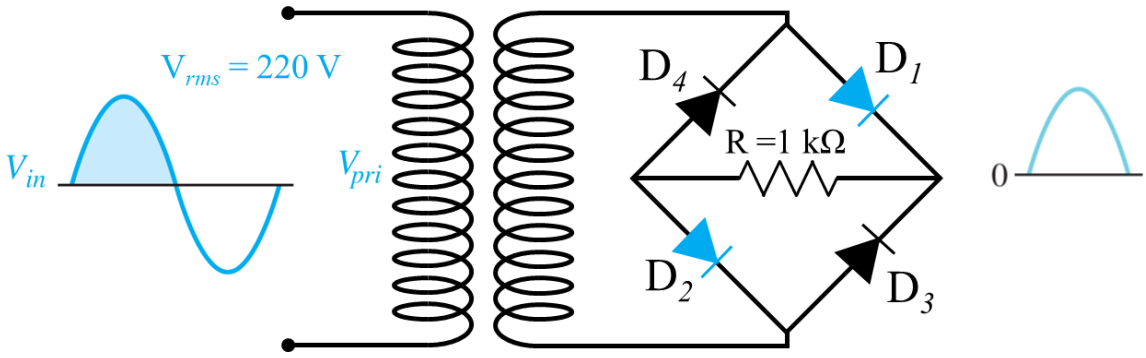

Figure 1: During positive half-cycles, D_1 and D_2 are forward-biased, and D_3 and D_4 are reverse-biased

During the negative half cycle, the diodes D_3 and D_4 are forward-biased, and D_1 and D_2 are reverse-biased. Therefore, the diodes D_3 and D_4 conduct and current flows through the load resistor R_L in the same direction, as shown in Fig. 2.

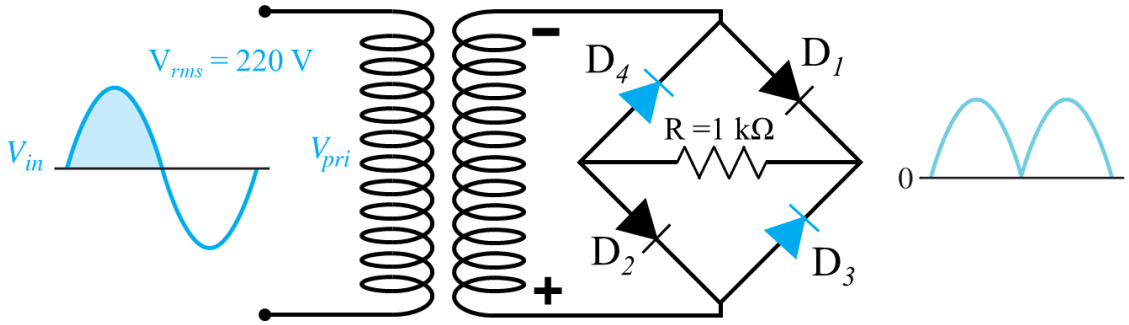

Figure 2: During negative half-cycles, D_3 and D_4 are forward-biased, and D_1 and D_2 are reverse-biased.

During both half cycles, there is a continuous current flow through the load resistor R_L, which will get a unidirectional current, as shown in Fig. 3.

The difference between center-tapped full-wave and bridge rectifiers is that a center-tapped full-wave rectifier requires two diodes only to rectify the full wave allowing unidirectional current to pass the load during the entire 2π of the input signal, as shown in Fig. 3.

However, it requires a center-tapped transformer. In contrast, a full-wave bridge rectifier requires four diodes and a standard (two terminal) transformer, allowing unidirectional current to pass the load as well.

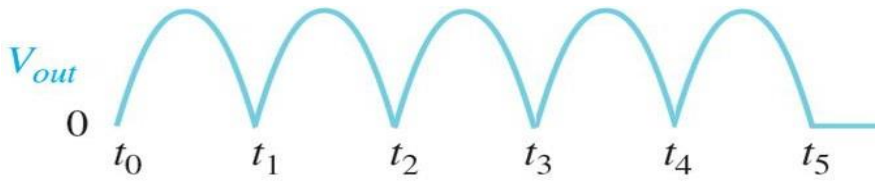

Figure 3: Fig. Output of a full-wave bridge rectifier

Average Value of the Output Voltage

The average value of a full wave rectified output voltage is the value you would measure on a DC voltmeter. It can be calculated with the following equation, where $V_{p(out)}$ is the peak value of the full wave rectified output voltage:

$$V_{AVG} = \frac{2V_{p(out)}}{\pi}$$

4. Experiment procedure

1. Connect the circuit as shown in Fig. 1 using a standard transformer, four diodes, a 1kΩ resistor (R_L)
2. Connect the primary winding to the 220 V and a frequency of 50 Hz.
3. Display the input and output signal on the oscilloscope.
4. Measure the $V_{p.p}$, V_{max}, V_{rms}, V_{AVG}, and input signal frequency.
5. Measure the $V_{p.p}$, V_{max}, V_{rms}, V_{AVG}, and output signal frequency.
6. Draw the input and output signal
7. Find the turns ratio (*n*) of the transformer
8. Tabulate your measurement results in a table as shown.

Input Signal (FWR) across sec. winding		**Output Signal (R_L)**	
V_{rms} =		V_{rms} =	
$V_{p(out)}$ =		V_p =	
$V_{p(sec)}$ =		$V_{p.p}$ =	
V_{AVG} =	(Exp.)	V_{AVG} =	(Exp.)
V_{AVG} =	(Theo.)	V_{AVG} =	(Theo.)
f =		*f* =	
Draw the input signal		Draw the output signal	
Find the turns ratio (*n*) of the transformer.			

5. Discussion

1. What would be the PIV of each diode in the above circuit?
2. On a graphic paper, draw the input and output signals on one chart (on top of each other), indicating the voltages (V_p, V_{rms}, and V_{AVG}).

3. Calculate the period of the input and output signals.