Experiment No.3

Center-Tapped Full-Wave Rectifier

1. Objectives:

- Construct the center-tapped full-wave rectifier circuit.
- Measure/plot the input and output waveform.
- Find the peak and average values of the output signal

2. Components and equipment

- A center-tapped transformer
- An two-channel Oscilloscope.
- An AVO meter
- Breadboard, two semiconductor Diodes, and 1KΩ Resistor.

3. Theory

The circuit of a center-tapped full wave rectifier uses two diodes D_1 and D_2. During the positive half cycle of secondary voltage, the diode D1 is forward-biased, and D_2 is reverse-biased. Therefore, the diode D_1 conducts, and current flows through load resistor R_L, as shown in Fig. 1.

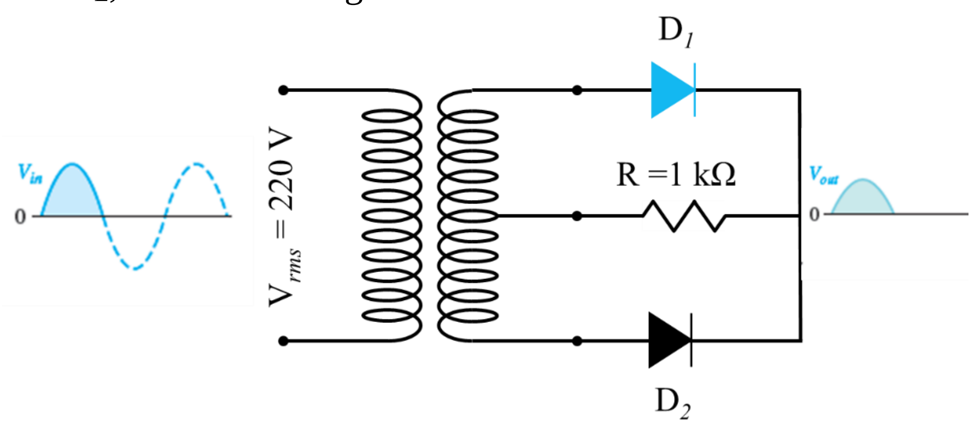

Figure 1: During positive half-cycles, D_1 is forward-biased, and D_2 is reverse-biased.

During the negative half cycle, diode D_2 becomes forward-biased and D_1 reverse-biased. In this case, D_2 conducts, and current flows through the load resistor R_L in the same direction.

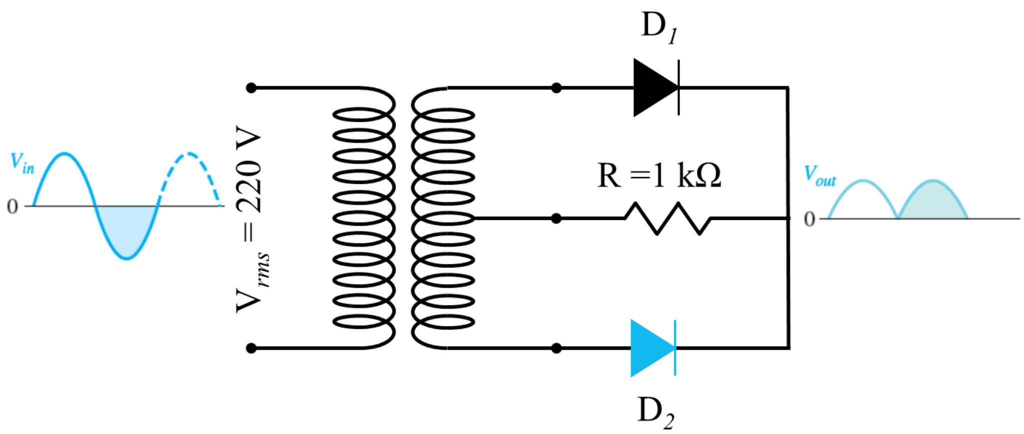

Figure 2: During negative half-cycles, D2 is forward-biased and D1 is reverse-biased.

During both half cycles, there is a continuous current flow through the load resistor R_L, and it will get a unidirectional current, as shown in Fig. 3. The difference between full-wave and half-wave rectification is that a full-wave rectifier allows unidirectional current to the load during the entire 2π of the input signal. In contrast, a half-wave rectifier allows this only during one-half cycle π.

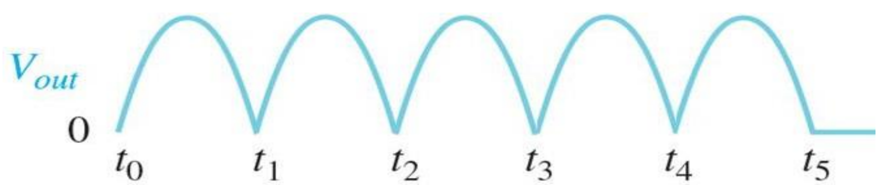

Figure 3: Fig. Output of a full-wave rectifier

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 center-tapped transformer, two 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 frequency of the input signal.
5. Measure the $V_{p.p,}$ $V_{max,}$ $V_{rms,}$ $V_{AVG,}$ and frequency of the output signal.
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. Is the transformer step-down or step-up? Why?
2. On a graphic paper, draw the input and output signals, both on one chart (on top of each other). Indicating the voltages (V_p, V_{rms}, and V_{AVG}).
3. What would be the output at R_L if we exchange D_1 by R_L?