

## GLP-F020

اسم القسم: هندسة تقنيات الأجهزة الطبية / اسم المختبر: النظم الالكترونية الطبية / المرحلة: الثالثة / رمز المختبر: BL

406

سجل التجارب للعام الدراسي 2023-2024

### Experiment No.1: **Full-wave Rectifier**

#### **Objectives:**

1. To construct a full-wave bridge rectifier circuit and analyze its output.
2. To analyze the rectifier output using a capacitor in shunt as a filter.

#### **Overview of the Full-wave Bridge Rectifier**

Power Diodes can be connected together to form a full wave rectifier that converts AC voltage into pulsating DC voltage for use in power supplies.

The full wave rectifier converts both halves of each waveform cycle into a pulsating DC signal using four rectification diodes. While this method may be suitable for low-power applications it is unsuitable for applications that need a “steady and smooth” DC supply voltage. One method to improve on this is to use every half-cycle of the input voltage instead of every other half-cycle. The circuit that allows us to do this is called a Full Wave Rectifier.

Like the half-wave circuit, a full-wave rectifier circuit produces an output voltage or current that is purely DC or has some specified DC component. Full-wave rectifiers have some fundamental advantages over their half-wave rectifier counterparts.

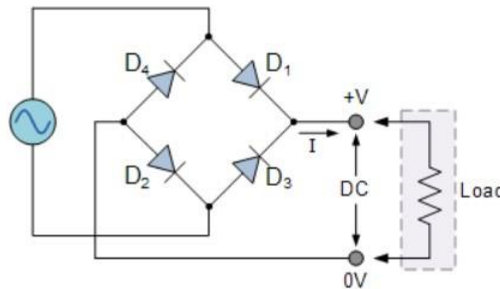


Figure 1. The Diode Bridge Rectifier.

The four diodes labeled  $D_1$  to  $D_4$  are arranged in “series pairs” with only two diodes conducting current during each half cycle.

During the positive half cycle of the supply, diodes  $D_1$  and  $D_2$  conduct in series while diodes  $D_3$  and  $D_4$  are reverse biased, and the current flows through the load as shown below.

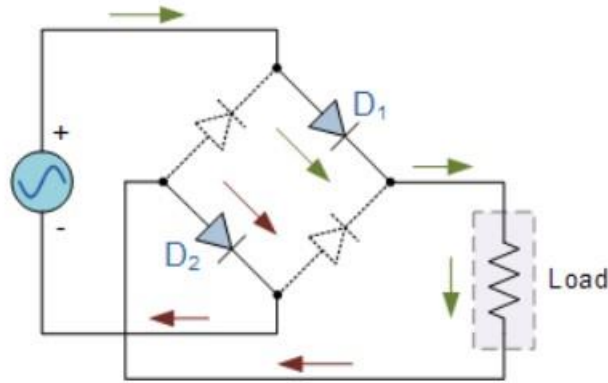


Figure 2. The Positive Half-cycle.

During the negative half cycle of the supply, diodes  $D_3$  and  $D_4$  conduct in series, but diodes  $D_1$  and  $D_2$  switch “OFF” as they are now reverse-biased. The current flowing through the load is in the same direction as before.

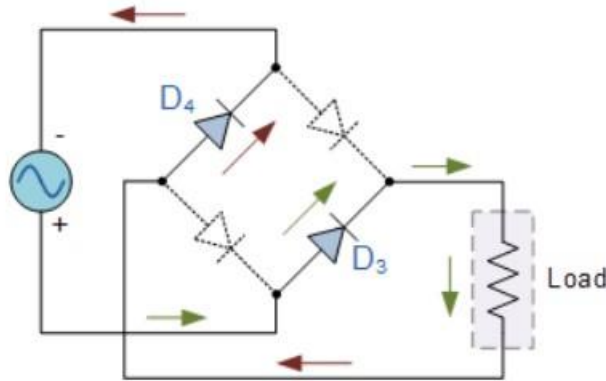


Figure 3. The Negative Half-cycle.

### Equipment and Tools:

1. Analog Circuit Experimental Box
2. Oscilloscope
3. Function Generator

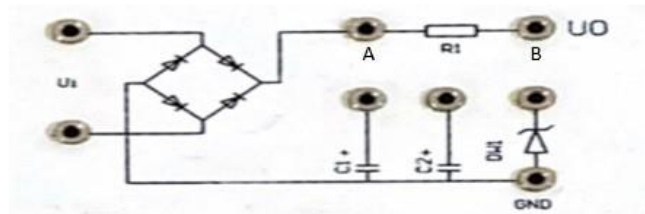


Figure 4. The full-wave rectifier circuit from the Experimental Box.

### The method of work:

#### Step 1:

Connect 12 V<sub>p,p</sub> Ac power supply to the oscilloscope to show the input waveform as shown in the figure below. After showing the waveform connect the Ac power to U1 to be as input for full-wave rectifier circuit.

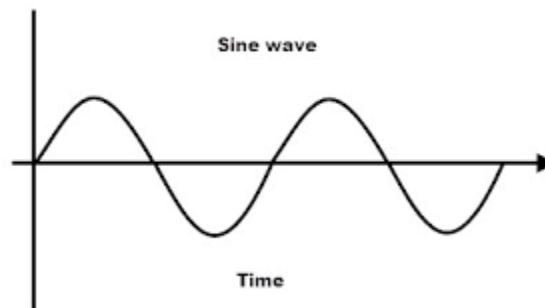


Figure 5. The input signal.

#### Step 2:

Connect RL to the Zener diode, and then connect an oscilloscope between port A and GND in order to see the waveform of the rectifier as shown if figure below.

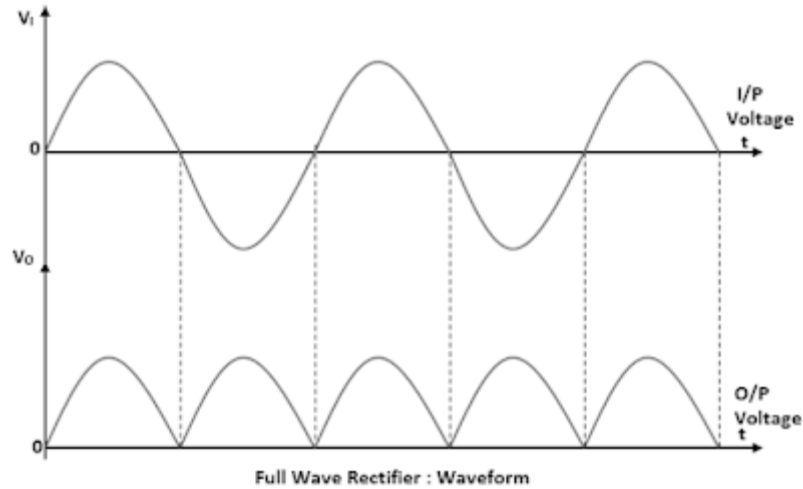


Figure 6. The waveform of a full-wave rectifier

### Step 3:

Connect C1 in parallel with RL (from port A to the capacitor), and then connect the oscilloscope with a capacitor so that it can display the waveform.

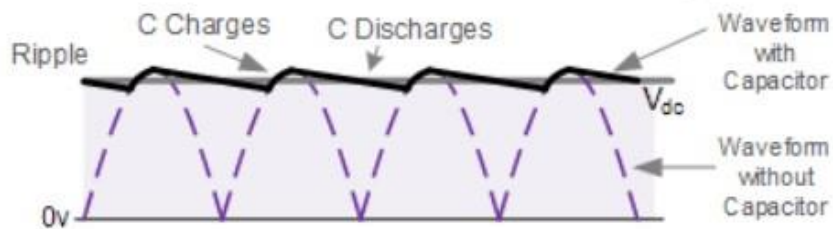


Figure 7. Resultant output waveform with capacitor.

### Step 4:

Connect the oscilloscope between the Zener diode and the ground to show the DC waveform

This is an important feature of the Zener diode, which can be used in voltage regulator applications. Therefore, a Zener diode is sometimes called a Voltage-regulator diode.

For example, full-wave or bridge rectifiers consist of ripples superimposed on a DC voltage. By connecting a simple Zener diode across the output of the rectifier, we can obtain a more stable DC output voltage.

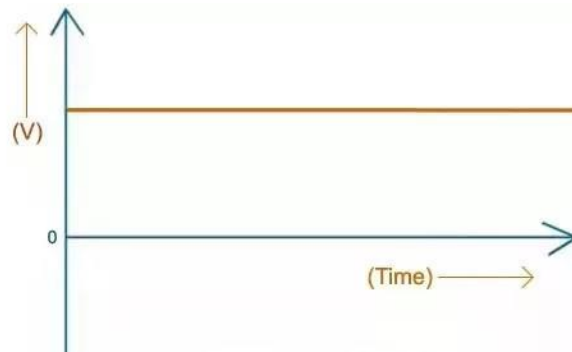


Figure 8. The DC waveform.

### Homework:

1. What's the benefit of a full-wave rectifier?
2. What's the effect of adding a capacitor?
3. How Zener diode affect the circuit?