Results

Part one:

Firstly, the simple half-wave rectifier circuit was constructed as shown in figure1. Then the DMM was used to measure the rms voltage across the load resistor. Table1 shows the readings of the experimental and the theoretical rms voltage when the value of the resistor is 2.2 KΩ and also when the value of the resistor is changed to 10KΩ. Also, the error between the theoretical and experimental values of voltage had been calculated by using the error's formula (see table1).

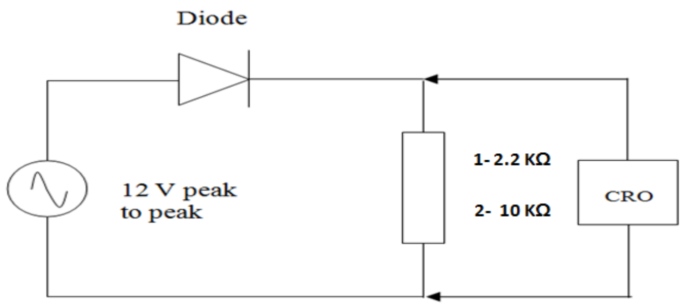

Figure1. The simple half wave rectifier circuit without capacitor.

Table1. Readings of part one.

Resistance (Ω)	Experimental rms value of voltage (V)	Theoretical rms value of voltage (V)	% Error
2.2 KΩ (Diode without capacitor)	With AC = 2.06 V With DC = 1.62 V	$V_{rms} = \frac{(2.7)(2)}{(2)} = 2.7\,V$	$\%error\ AC = \left\|\frac{2.7-2.06}{2.7}\right\| \times 100 = 23.7\%$ $\%error\ DC = \left\|\frac{2.7-1.62}{2.7}\right\| \times 100 = 40\ \%$
10 KΩ (Diode without capacitor)	With AC = 2.12 V With DC = 1.69 V	$V_{rms} = \frac{(2.8)(2)}{(2)} = 2.8\,V$	$\%error\ AC = \left\|\frac{2.8-2.12}{2.8}\right\| \times 100 = 24.3\%$ $\%error\ DC = \left\|\frac{2.8-1.69}{2.8}\right\| \times 100 = 39.6\ \%$

Formulas that we used in calculation:

- The RMS value of the load voltage = $\frac{V_m}{2}$ **(Half Wave)**
- The % Error = $\frac{|\text{theoretical value} - \text{experimental value}|}{\text{theoretical value}}$ x 100

Figure2 shows the waveform of the rectified voltage on the oscilloscope across the load resistor (2.2 KΩ).

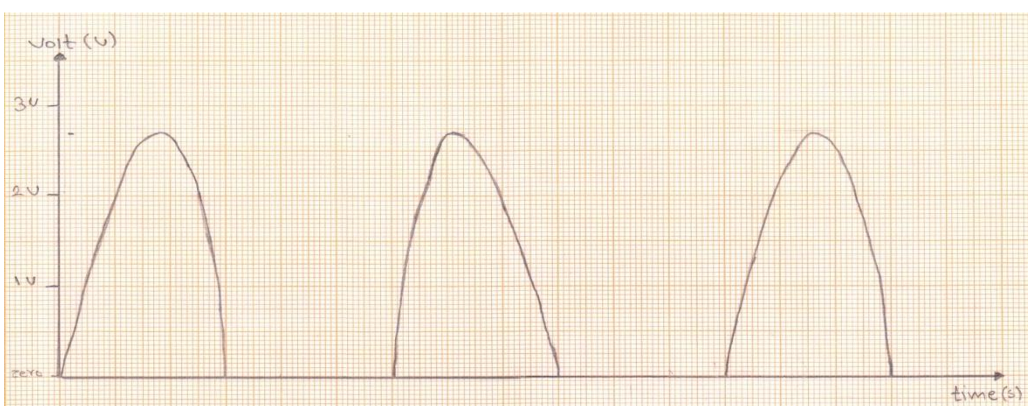

Figure2. The waveform of the rectified voltage (Half wave).

Figure3 shows the waveform of the rectified voltage on the oscilloscope across the load resistor (10 KΩ).

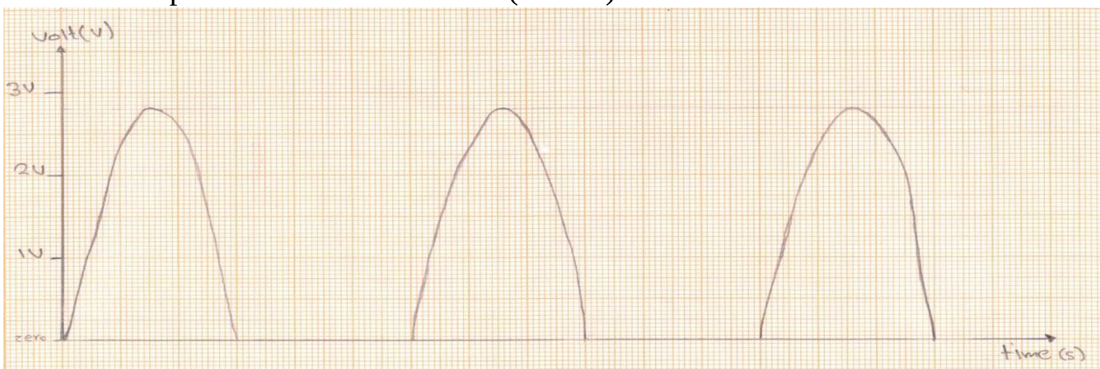

Figure3. The waveform of the rectified voltage (Half wave).

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Part two:

As shown in figure4 the electrolytic capacitor was connected in parallel to the 2.2 kΩ resistor. The DMM was used to measure the rms voltage across the load resistor. Table2 shows the readings of the experimental and the theoretical (which is the ripple voltage) rms voltage when the value of resistor the is 2.2 KΩ and also when the value of the resistor is changed to 10KΩ. Also, the error between the theoretical and experimental values of voltage had been calculated by using the error's formula (see table2).

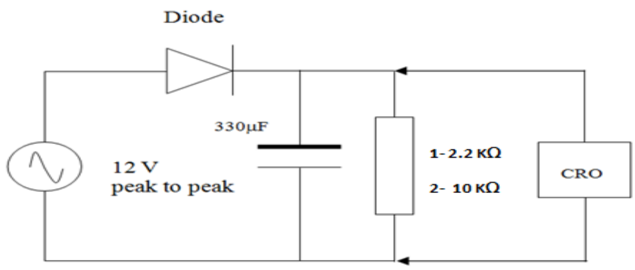

Figure4. The simple half wave rectifier circuit with capacitor parallel to the resistor .

Table2. Readings of part two.

Resistance (Ω)	Experimental rms value of voltage (V)	Theoretical rms value of voltage (V)	% Error
2.2 KΩ **(Diode with capacitor)** **(on the oscilloscope : 500 mV – 5mS)**	4.52 V	$V_{ripple} = 0.4 \times 500 \times 10^{-3} = 0.2\ V$	$\left\lvert\frac{0.2 - 4.52}{0.2}\right\rvert \times 100 = 2160\%$
10 KΩ **(Diode with capacitor)** **(on the oscilloscope : 500 mV – 5mS)**	5.12 V	$V_{ripple} = 0.2 \times 500 \times 10^{-3} = 0.1\ V$	$\left\lvert\frac{0.1 - 5.12}{0.1}\right\rvert \times 100 = 5020\%$

Formulas that we used in calculation:

- The ripple voltage = (The value of the voltage on the oscilloscope) × (The number of the squares on the oscilloscope)
- The % Error = $\frac{|\text{theoretical value} - \text{experimental value}|}{\text{theoretical value}}$ x 100

Figure5 shows the waveform of the rectified voltage on the oscilloscope across the load resistor (2.2 KΩ parallel with electrolytic capacitor).

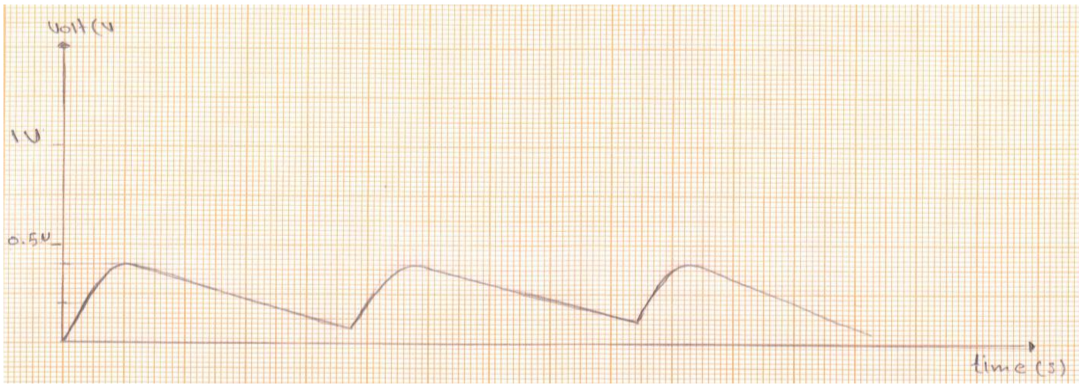

Figure5. The waveform of the rectified voltage (Half wave).

Figure6 shows the waveform of the rectified voltage on the oscilloscope across the load resistor (10 KΩ parallel with electrolytic capacitor).

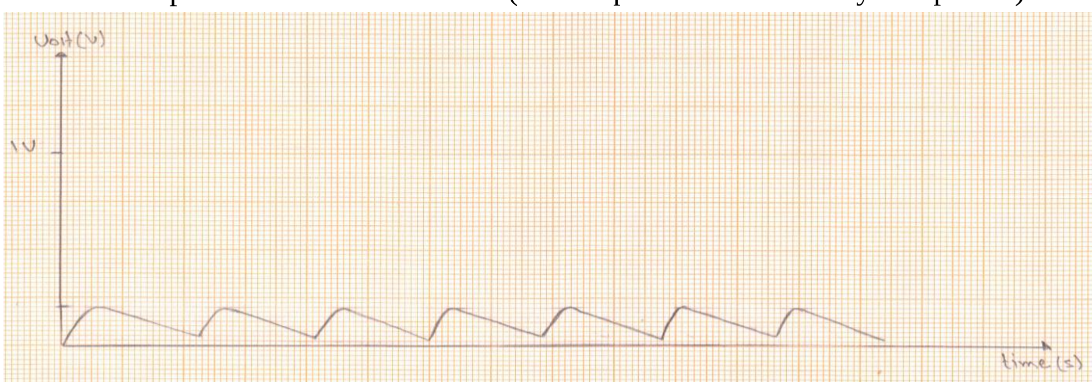

Figure6. The waveform of the rectified voltage (Half wave).

Part three:

Firstly, the simple full-wave rectifier circuit was constructed as shown in figure7. The DMM was used to measure the rms voltage across the load resistor. Table3 shows the readings of the experimental and the theoretical rms voltage when the value of the resistor is 2.2 KΩ and also when the value of the resistor is changed to 10KΩ. Also, the error between the theoretical and experimental values of voltage had been calculated by using the error's formula (see table3).

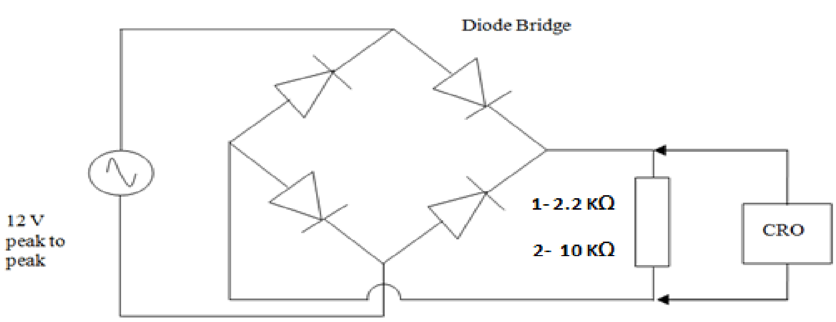

Figure7. The simple full wave rectifier circuit without capacitor.

Table3. Readings of part three.

Resistance (Ω)	Experimental rms value of voltage (V)	Theoretical rms value of voltage (V)	% Error
2.2 KΩ **(Diode Bridge without capacitor)**	2.78 V	$V_{rms} = \frac{(2.4)(2)}{(\sqrt{2})} = 3.4\,V$	$\left\lvert\frac{3.4 - 2.78}{3.4}\right\rvert \times 100 = 18.2\%$
10 KΩ **(Diode Bridge without capacitor)**	3.48 V	$V_{rms} = \frac{(2.5)(2)}{(\sqrt{2})} = 3.5\,V$	$\left\lvert\frac{3.5 - 3.48}{3.5}\right\rvert \times 100 = 0.6\%$

Formulas that we used in calculation:

- The RMS value of the load voltage = $\frac{V_m}{\sqrt{2}}$ **(Full Wave)**
- The % Error = $\frac{|\text{theoretical value} - \text{experimental value}|}{\text{theoretical value}}$ x 100

Figure8 shows the waveform of the rectified voltage on the oscilloscope across the load resistor (2.2 KΩ).

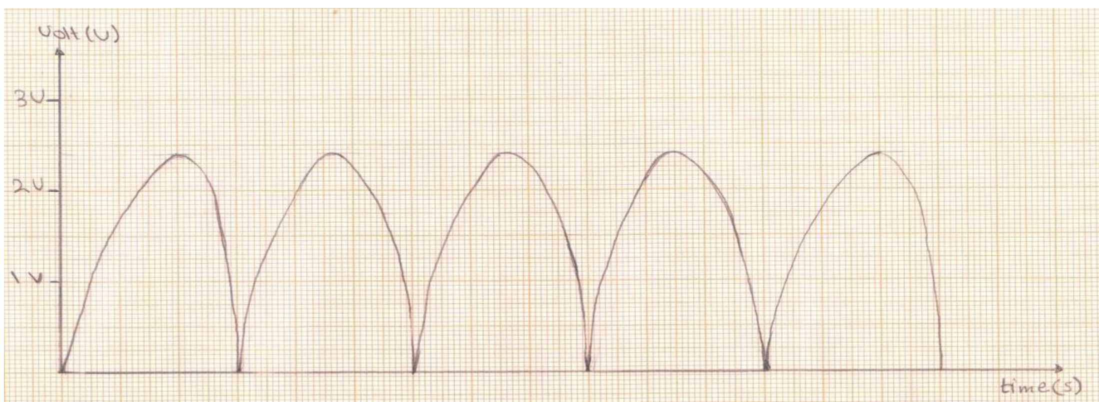

Figure8. The waveform of the rectified voltage (Full wave).

Figure9 shows the waveform of the rectified voltage on the oscilloscope across the load resistor (10 KΩ).

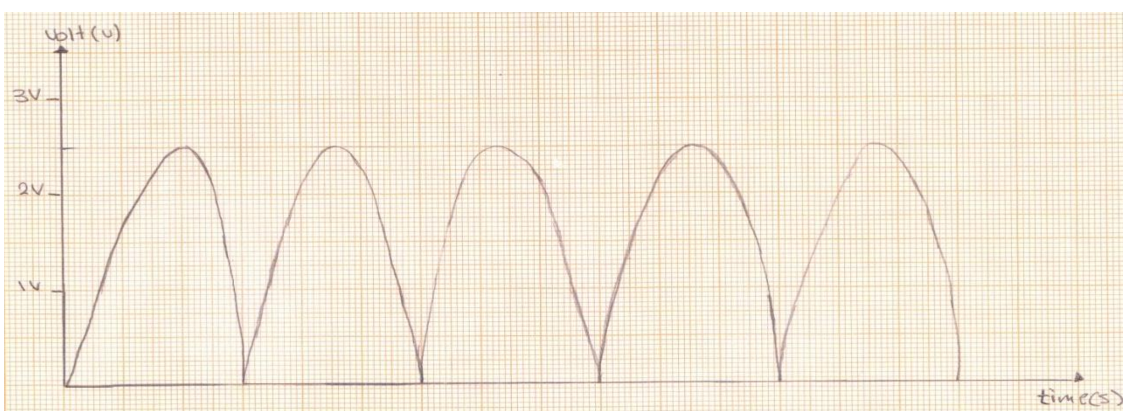

Figure9. The waveform of the rectified voltage (Full wave).

Part four:

As shown in figure10 the electrolytic capacitor was connected in parallel to the 2.2 kΩ resistor. The DMM was used to measure the rms voltage across the load resistor. Table4 shows the readings of the experimental and the theoretical (which is the ripple voltage) rms voltage when the value of the resistor is 2.2 KΩ and also when the value of the resistor is changed to 10KΩ. Also, the error between the theoretical and experimental values of voltage had been calculated by using the error's formula (see table4).

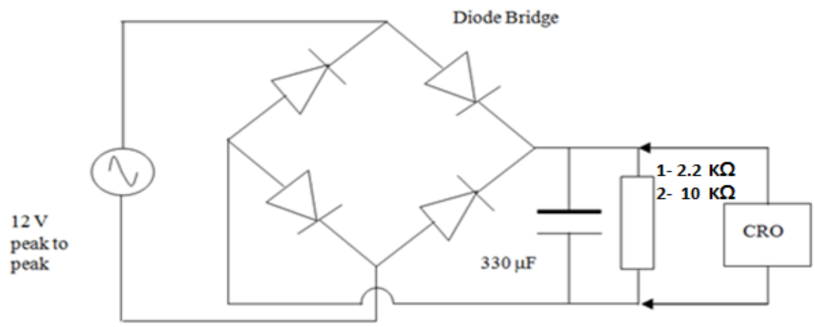

Figure10. The simple full wave rectifier circuit with capacitor parallel to the resistor.

Table4. Readings of part four.

Resistance (Ω)	Experimental rms value of voltage (V)	Theoretical rms value of voltage (V)	% Error
2.2 KΩ (Diode Bridge with capacitor) (on the oscilloscope : 200 mV – 2mS)	4.26 V	$V_{ripple} = 0.4 \times 200 \times 10^{-3} = 0.08\,V$	$\left\|\frac{0.08 - 4.26}{0.08}\right\| \times 100 = 5225\%$
10 KΩ (Diode Bridge with capacitor) (on the oscilloscope : 200 mV – 2mS)	4.73 V	$V_{ripple} = 0.2 \times 200 \times 10^{-3} = 0.04\,V$	$\left\|\frac{0.04 - 4.73}{0.04}\right\| \times 100 = 11725\%$

Formulas that we used in calculation:

- The ripple voltage = (The value of the voltage on the oscilloscope) × (The number of the squares on the oscilloscope)
- The % Error = $\frac{|\text{theoretical value} - \text{experimental value}|}{\text{theoretical value}}$ x 100

Figure11 shows the waveform of the rectified voltage on the oscilloscope across the load resistor (2.2 KΩ parallel with electrolytic capacitor).

Figure11. The waveform of the rectified voltage (Full wave).

Figure12 shows the waveform of the rectified voltage on the oscilloscope across the load resistor (10 KΩ parallel with electrolytic capacitor).

Figure12. The waveform of the rectified voltage (Full wave).

Important Note:

- The drawing scale for figure 2, 3, 8 and 9 is 0.2 volt for every four lines.
- The drawing scale for figure 5, 6, 11 and 12 is 0.2 volt for every eight lines.