Department of Computer Engineering
Digital Hardware Systems
CpEA 2202 – Electronic Circuits

Laboratory Report

Laboratory Exercise No.:	2	**Date Performed:**	February 7, 2025
Laboratory Exercise Title:	Rectifier Circuits		
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Part I: Theory

A rectifier is an electrical device that converts alternating current to direct current by allowing current to flow in one direction. This process is called rectification, and it is essential to allow electrical devices requiring constant DC voltage, like computers, battery chargers, and LED bulbs, to work. Rectifiers find application in power supplies and form essential components of most electrical systems. Usually, they are made from diodes, which perform the function of one-way valves for electric current, allowing the desired polarity to reach the output.

Rectifiers can be of different types whereby they are categorized as half-wave and full-wave rectifiers. A half-wave rectifier stops the other half of the AC wave form, with a pulsating DC current with a very high-power loss in the process. A full-wave rectifier, on the other hand, takes both halves of the AC wave form for a comparatively less pulsating and more effective output. Full-wave rectifiers are implemented in either two-diode configurations using a center-tapped transformer, or in bridge rectifier configurations with four diodes. Advanced designs of rectifiers which include controlled rectifiers based on the thyristors type are used in industrial applications when an important need for voltage regulation arises.

Part II: Constructing a Half-wave Rectifier

Figure 1: Half-wave Rectifier Circuit

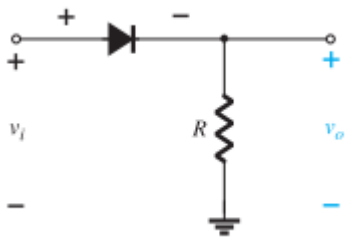


Figure 2: Actual Half-wave Rectifier Circuit

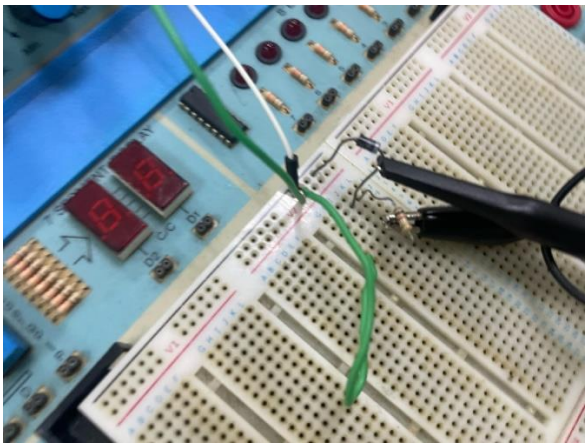


Figure 3: Actual Half-wave Rectifier/Capacitor

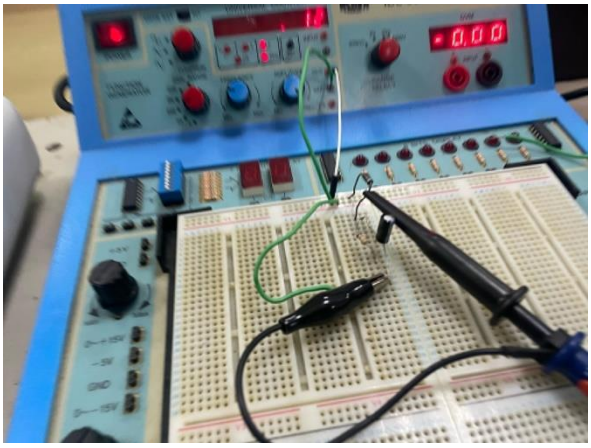
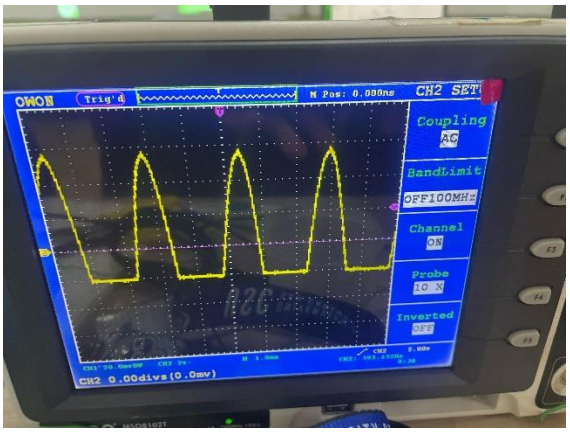
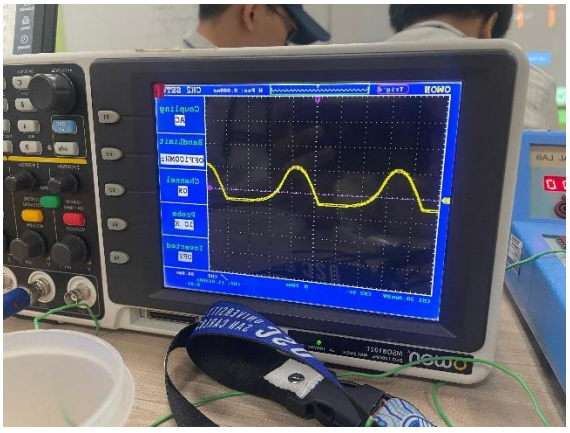


Figure 4: Half-wave Rectifier Wave



Time Per Division: 50ms
Voltage Per Division:2V
Output Voltage(Vo): 6V

Figure 5: Half-wave Rectifier Wave w/ Capacitor



Time Per Division:50ms
Voltage Per Division:2V
Output Voltage(Vo): 6V

Part III: Constructing Full-wave Rectifier

Figure 1.2: Full-wave Rectifier Circuit

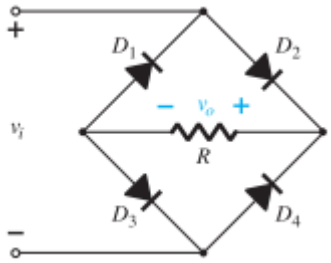


Figure 2.2: Actual Full-Wave Rectifier Circuit

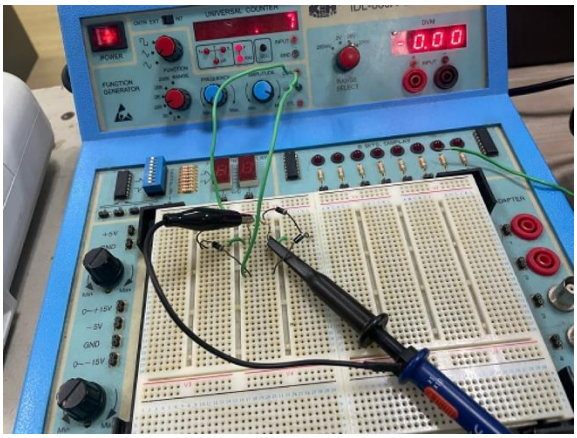


Figure 3.2: Actual Full-Wave w/ Capacitor

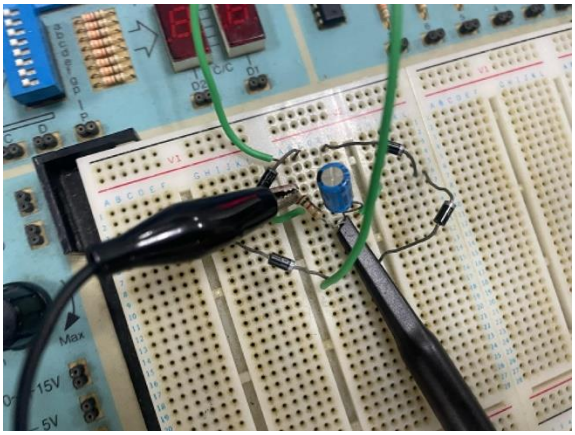
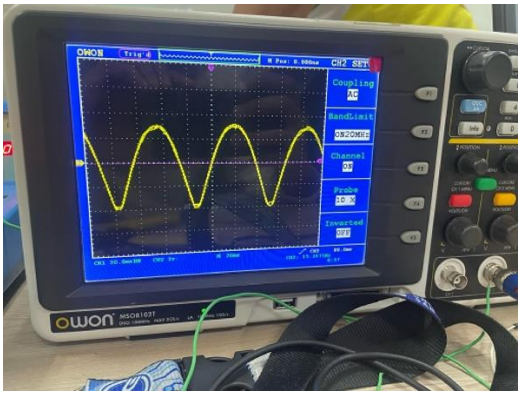
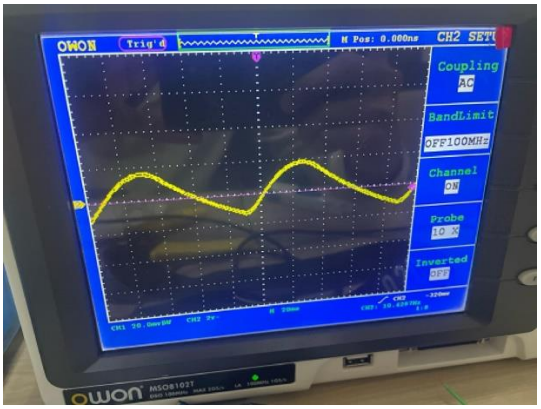


Figure 4.2 Full-Wave Rectifier Circuit Wave



Time Per Division:20ms
Voltage Per Division:2V
Output Voltage(Vo): 6V

Figure 5.2 Full- Wave Rectifier Circuit Wave w/ Capacitor



Time Per Division:10ms
Voltage Per Division:1V
Output Voltage(Vo): 6V

Part IV: Observations

1. Look at waveform plots of Table 1 and 2 and write your observations on the half-wave rectifier:

The half-wave rectifier is basically able to pass only the positive half of the AC signal and get rid of the negative part. If there is no capacitor, there will be zero output voltage and gaps will appear in the output. This is due to the output pick-up smoothing-up of the capacitors upon being charged; it, however, only reduces some of the fluctuations but does not eliminate them.

2. Similarly, write your observations on the full-wave rectifier from Table 3 & 4:

A full-wave rectifier converts both halves of the AC signal into continuous positive pulses. This means less pulsation is present on output. The output will have ripples, but there will be no full drop to complete zero. By adding a capacitor, more steady and smoothed voltage is achieved, as it is closer to pure DC.

3. What is the practical use of a rectifier?

Power supplies incorporate rectifiers to convert widespread AC voltages to DC for electronic devices such as chargers, adapters, and battery-operated devices. Among the available types, full-wave rectification is desirable because it offers efficient and steady DC output that is a requirement for most electronic circuits to work smoothly.

4. What is the effect of adding a capacitor parallel to vo?

A capacitor smooths out the rectified output, reducing the fluctuations in the voltage. It stores charge when it is high and gives charge back when it drops, providing a more constant DC voltage. It has a greater capacity to minimize voltage fluctuations in a full-wave rectifier, leaving a steadier output than a half-wave rectifier does.

References

[1] R. L. Boylestad and L. Nashelsky, *Electronic Devices and Circuit Theory*, 10th ed. Upper Saddle River, NJ, USA: Prentice Hall, 2009.

[2] J. Millman and A. Grabel, *Microelectronics*, 2nd ed. New York, NY, USA: McGraw-Hill, 1987.

[3] A. Sedra and K. C. Smith, *Microelectronic Circuits*, 7th ed. New York, NY, USA: Oxford Univ. Press, 2015.

[4] M. H. Rashid, *Power Electronics: Circuits, Devices, and Applications*, 4th ed. Upper Saddle River, NJ, USA: Pearson, 2013.