LAB 2: Rectifiers and Filters

**Reg.# \_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_**

## OBJECTIVES:

## To implement a half wave rectifier.

## To implement a full-wave rectifier.

## To study the effect of filter capacitors on rectifier output.

## SUGGESTED READING:

* [Chapter 3: “Diode Applications”, *introductory Electronic Devices and Circuits by Paynter.*](http://arduino.cc/en/Guide/HomePage)
* Datasheet : 1N4007 rectifier diode

## EQUIPMENT AND COMPONENTS:

* Basic Circuits Training Board
* 1N4007 Rectifier Diode
* Light Emitting Diode
* Jumper Wires
* Scope / DMM
* Electrolyte Capacitors (1uF, 2.2uF, 10uF, 100uF)
* Voltage Transformer

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## Rectification:

Rectification is a process of converting AC signals into DC signals. Rectification can be performed using diodes in series with the voltage source. There are two main types of diode rectifiers:

- Half-wave rectifiers

- Full-wave rectifiers

## Half Wave Rectifiers:

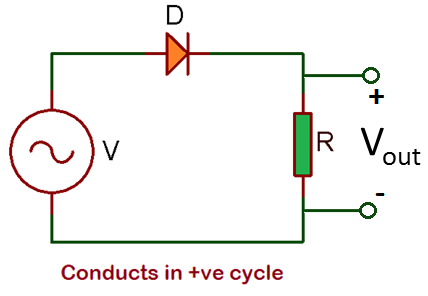
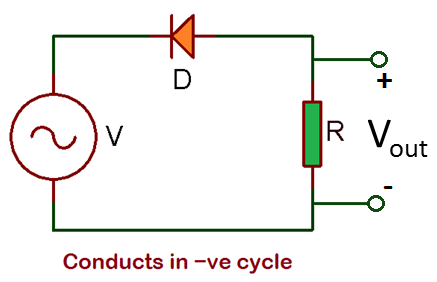
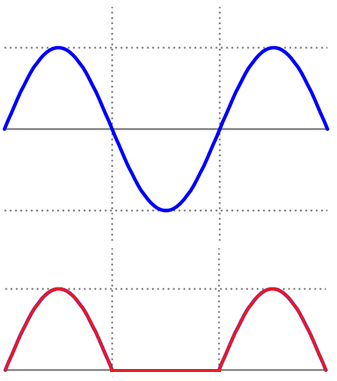


Fig 3.1: Half Wave Rectifier

A single diode connected in series with an AC voltage source forms a half-wave rectifier (Fig 3.1). The diode conducts only positive or only negative half cycle, depending on its orientation in the circuit (Fig 3.2).



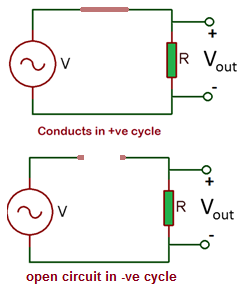
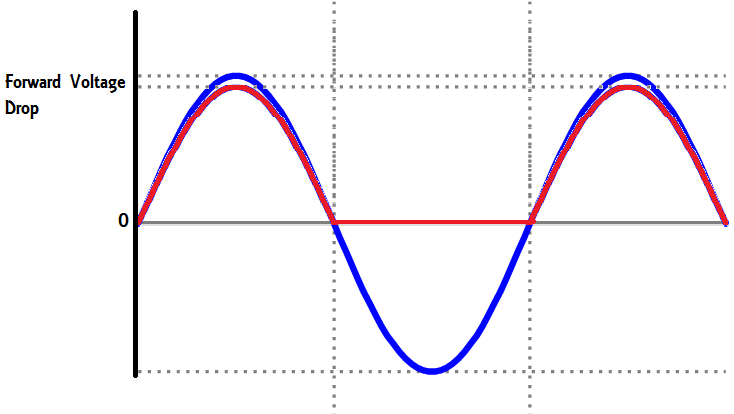


Fig 3.2: Half Wave Rectifier Output

The output of a half-wave rectifier is described by:

* VAV = Vmax/π



## Full Wave Bridge Rectifier:

Full-wave rectifiers can be made using four diodes in a bridge configuration (Fig 3.3).

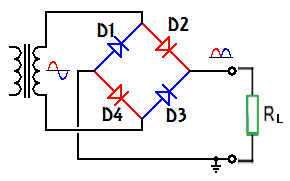
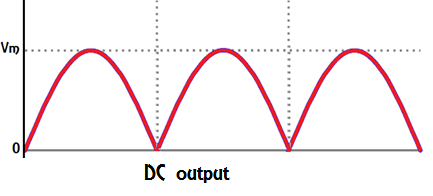
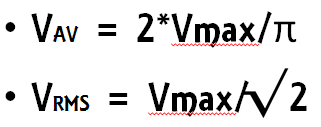


Fig 3.3: Full Wave Bridge Rectifier

The bridge rectifiers are the most commonly used bridge rectifiers due to high average output and fewer variations in output.





## Procedure:

TASK1:

* Connect one rectifier in series with the AC output from the 12V transformer to make the positive half-wave rectifier.
* Using scope view the input and output signals and record the maximum value of the output.
* Connect the diode in opposite polarity to make the negative half-wave rectifier and record the maximum value of the output.

TASK2:

* Connect four diodes in the bridge configuration:

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* Analyze the output by viewing it via palm-scope.
* Record the maximum value of the output.
* Repeat the process and record the values of input voltage, output voltage, the current through the diode, and current through the load.

TASK3:

* Re-connect the circuit in half-wave diode rectifier configuration.
* Connect a small (1uF) capacitor with the output and observe the effect of the capacitor on the output.
* Connect increasingly larger values of capacitors and observe their effects on the rectifier outputs.
* Now vary the load resistance and observe the effects on the rectifier output.

## REVIEW QUESTIONS:

Q**: What rectifier would you prefer to use, and why?**

**Ans:**

  The primary application of **rectifiers** is to derive DC power from an AC supply (AC to DC converter). **Rectifiers** are **used** inside the power supplies of virtually all electronic equipment. AC/DC power supplies may be broadly divided into linear power supplies and switched-mode power supplies.

Q: **Write down the average and RMS values of both rectifier outputs.**

**Ans:**

The ratio **of RMS value** to the **average value of** an alternating quantity is known as its form factor. **RMS voltage of** a **half wave rectifier**, V**RMS** = Vm / 2 and **Average Voltage** V**AVG**= Vm/π, Vm is the peak **voltage**.

1. **Average voltage**, VDC = Vm/2π 0∫π sinωt dωt.
2. Form factor of **half wave rectifier** = V**RMS** / VAVG = ( Vm /2 ) / ( Vm / π )
3. Form factor **value of full wave rectifier** = ( Vm / √ 2 ) / ( 2Vm / π )

Q**: Describe the effects of filter capacitance on the rectifier output.**

**Ans:**

Being that **capacitors** have offer very high resistance to low frequency signals and low resistance to high frequency signals, it acts as a high pass **filter**, which is a **filter** which passes high frequency signals and blocks low frequency signals.

Q**: Can the bridge rectifier be used to generate negative voltages? Explain using figure.**

**Ans:**

 This sounds like a homework problem except for the use of the word ‘generate’ and ‘explain using figures’ unless that means a drawing of a rectifier circuit. As can be seen looking at a bridge rectifier, there is a positive and a negative terminal so selecting one as the reference determines wither the supply output will be positive or negative just like the output of a battery.

Q**: Plot two periods of your output (approximated) of half-wave rectifier using MS Excel.**

**Ans:**

Assignment

***Design a model of the half-wave rectifier and full-wave rectifier.***

Rectifier (diode capacitor, load resistance)

Input voltage (reg.#)

Scope (four terminals)

Input waveform

Voltage after rectifier

Voltage after capacitor

Current waveform

Print this circuit and calculate (by hand) average voltage, peak voltage, ripple factor, inverse peak voltage.

Make a pdf and send it on WhatsApp.