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Experiments of analog electronics laboratory

Lab(3)

The half–wave rectifier circuit

1. Aim of the experiment :

Principle of the half–wave rectifier circuit

1. without smoothing capacitor
2. with a smoothing capacitor

2. The theory:

What is a Half Wave Rectifier?

A **half-wave rectifier** is defined as a type of rectifier that only allows one half-cycle of an AC voltage waveform to pass, blocking the other half-cycle. Half-wave rectifiers are used to convert AC voltage to DC voltage and only require a single diode to construct.

A rectifier is a device that converts alternating current (AC) to direct current (DC). It is done by using a diode or a group of diodes. Half wave rectifiers use one diode, while a full wave rectifier uses multiple diodes.
The working of a half wave rectifier takes advantage of the fact that diodes only allow current to flow in one direction.
A half-wave rectifier is the simplest form of rectifier available.

The diagram below illustrates the basic principle of a half-wave rectifier. When a standard AC waveform is passed through a half-wave rectifier, only half of the AC waveform remains. Half-wave rectifiers only allow one half-cycle (positive or negative half-cycle) of the AC voltage through and will block the other half-cycle on the DC side, as seen below. Only one diode is required to construct a half-wave rectifier. In essence, this is all that the half-wave rectifier is doing.

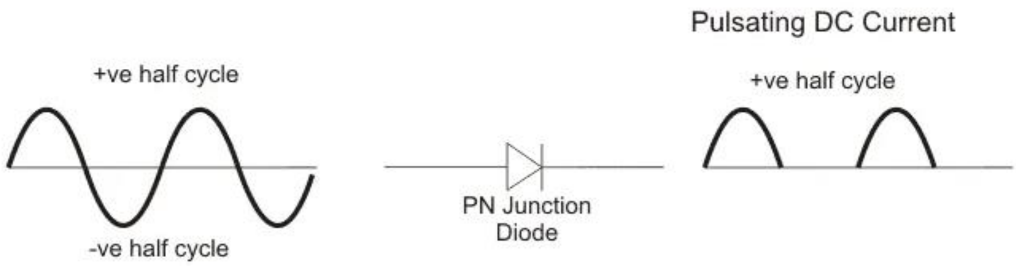
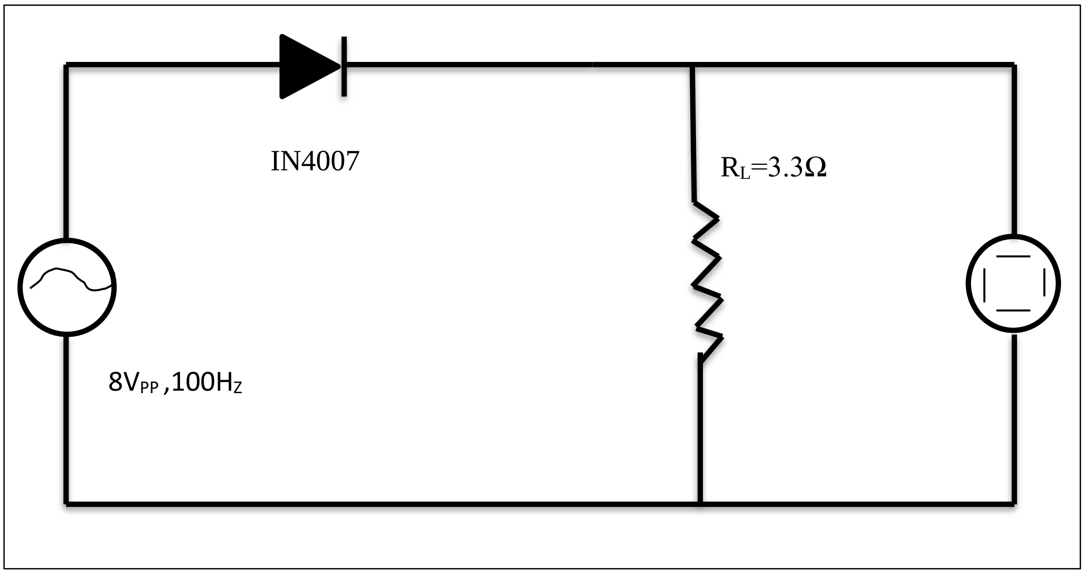


Figure - 1

3. Practical part:

a. Assemble the below circuit without the smoothing capacitor.



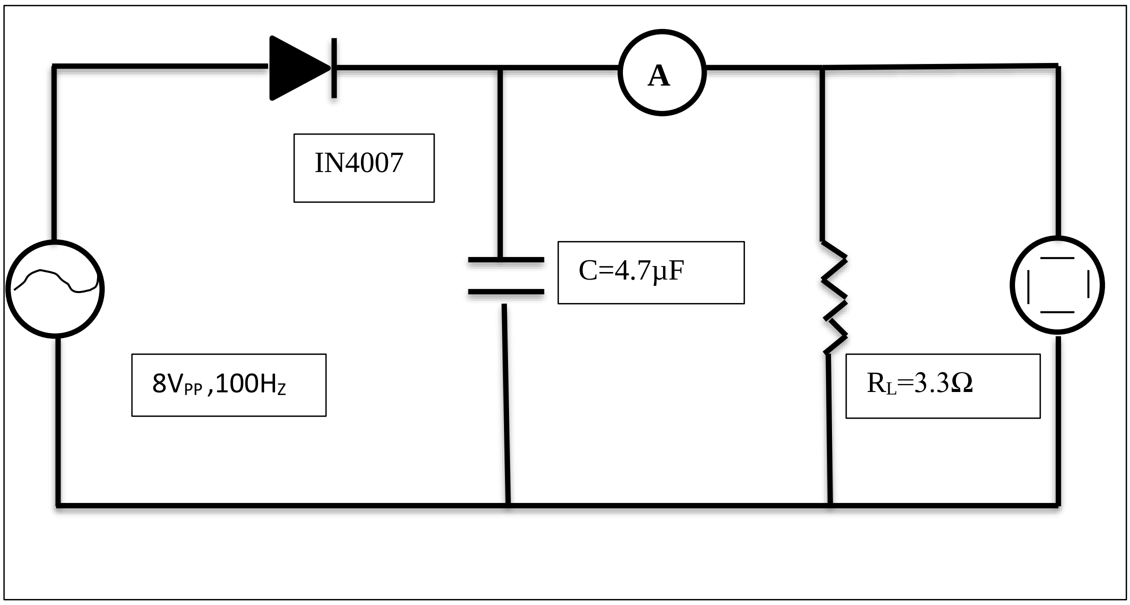
2. Adjust the voltage V=8 volt, F=100H_Z .

3. using CRO, measure V_m on resistance (R_L).

4. Measure V_{dc} on the R_L and compare that value with theoretical value

$$V_{dc}\,\frac{V_m}{\pi}$$

b. Now assemble the circuit with a smoothing capacitor C=4.7µF.



1. Use CRO to measure V_r (ripple voltage).

2. Calculate V_r value theoretically as follows:

$$V_r = \frac{I_{dc}}{Cf}$$

3. find V_{dc} value as

$$V_{dc} = V_m - \frac{V_r}{2}$$

4. compare the V_{dc} value theoretically with the V_{dc} value practically, using a multimeter on resistance R_L.

Finally

We can find (a ripple factor) from

$$r = \frac{1}{2\sqrt{3}CfR_L}$$

Lab(4)

The full–wave rectifier circuit

1. Aim of the experiment :

Principle of the full–wave rectifier circuit

1. without smoothing capacitor
2. with smoothing capacitor

2. The theory:

a.What is a full Wave Rectifier?

A full wave rectifier is defined as a rectifier that converts the complete cycle of alternating current into pulsating DC.

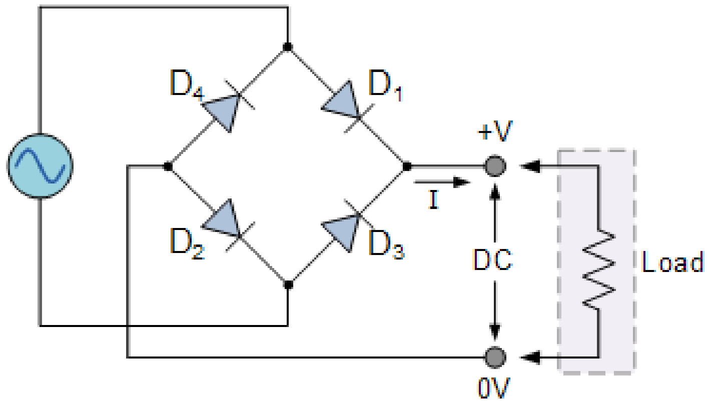
Full Wave Bridge Rectifier. This type of single phase rectifier uses four individual rectifying diodes connected in a closed loop “bridge” configuration to produce the desired output.

The main advantage of this bridge circuit is that it does not require a special centre tapped transformer, thereby reducing its size and cost. The single secondary winding is connected to one side of the diode bridge network and the load to the other side as shown below.

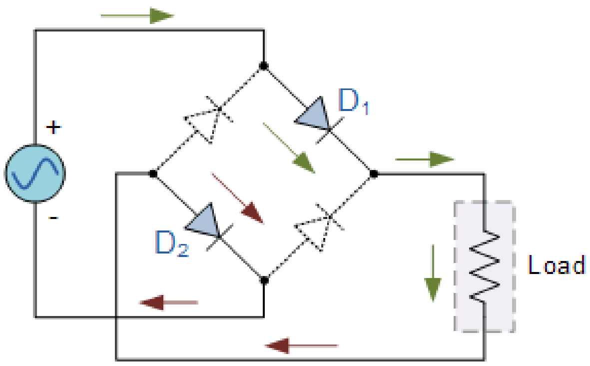
b. The Diode Bridge Rectifier

The four diodes labelled 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 D1 and D2 conduct in series while diodes D3 and D4 are reverse biased and the current flows through the load as shown below.

The Diode Bridge Rectifier

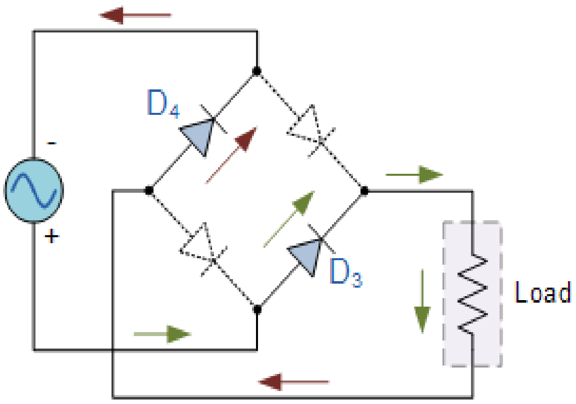


The Positive Half-cycle



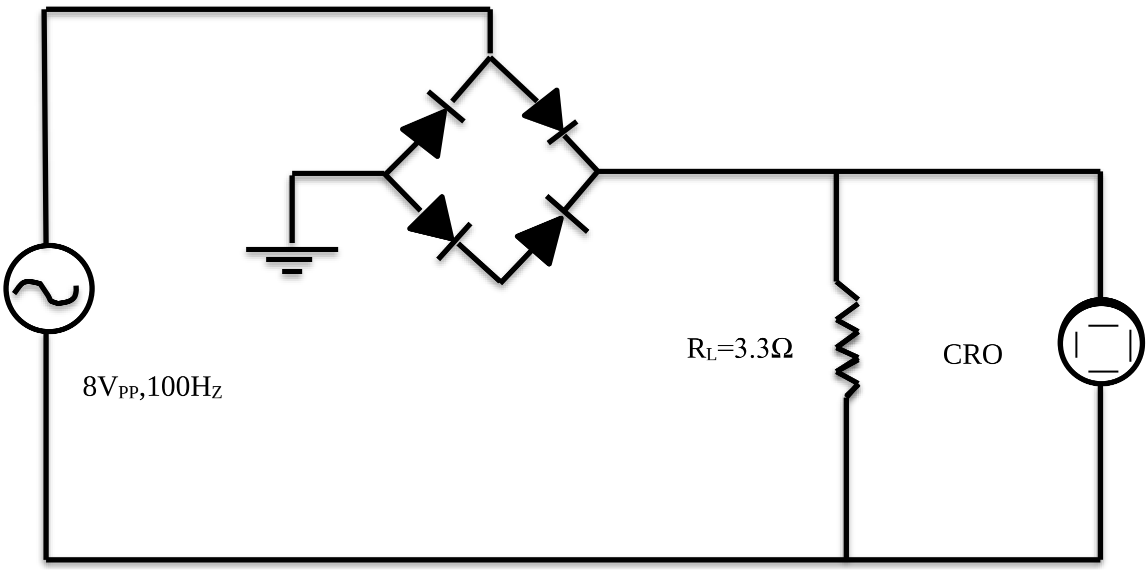
During the negative half cycle of the supply, diodes D3 and D4 conduct in series, but diodes D1 and D2 switch "OFF" as they are now reverse biased. The current flowing through the load is the same direction as before.

The Negative Half-cycle



4. Practical part:

a. Assemble the below circuit without the smoothing capacitor.



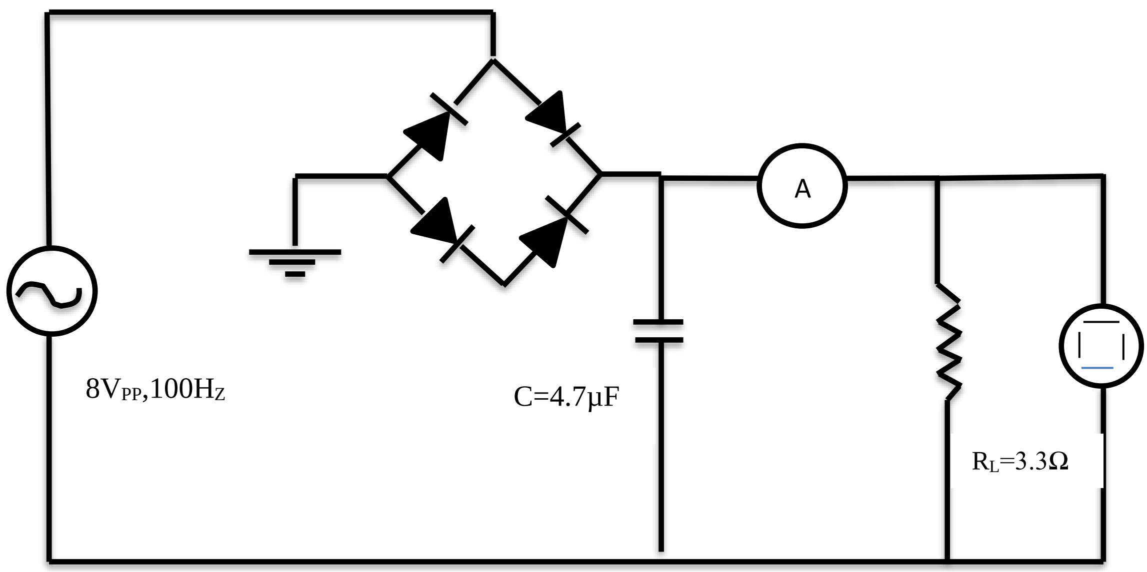
1. Adjust the voltage V=8 volt, F=100Hz.

2. using CRO, measure V_m on resistance (R_L).

3. Measure V_{dc} on the R_L and compare that value with the theoretical value

$$V_{dc} \frac{2V_m}{\pi}$$

b. Now assemble the circuit with a smoothing capacitor C=4.7µF.



1. Use CRO to measure V_r (ripple voltage).

2. Calculate V_r value theoretically as follows:

$$V_r = \frac{I_{dc}}{2Cf}$$

3.find V_{dc} value as

$$V_{dc} = V_m - \frac{V_r}{2}$$

e. compare the V_{dc} value theoretically with the V_{dc} value practically, using a multimeter on resistance R_L.

Finally

We can find (a ripple factor) from

$$r = \frac{1}{4\sqrt{3}CfR_L}$$