Half-Wave-Rectifier_ -- Overview

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Objective:

After performing this experiment student must be able to

- Understand the Circuit behaviour the Half wave Rectifier
- Construct the Halfwave Rectifier with the required equipment
- Plot output waveform of a Halfwave rectifier.
- Evaluate the Ripple factor for the Halfwave Rectifier
- Evaluate the efficiency for a Halfwave Rectifier.

Apparatus:

- Junction Diode IN4001
- A230v/12v stepdown Transformer
- Resistor 1kohm
- Bread Board
- CRO

Theory:

- A device is capable of converting a sinusoidal input waveform into a unidirectional waveform with non zero average component is called a rectifier.
- A practical half wave rectifier with a resistive load is shown in the circuit diagram. During the positive half cycle of the input the diode conducts and all the input voltage is dropped across RL. During the negative half cycle the diode is reverse biased and is in FF state and so the output voltage is zero.
- The filter is simply a capacitor connected from the rectifier output to ground. The capacitor quickly charges at the beginning of a cycle and slowly discharges through RL after the positive peak of the input voltage.
- The variation in the capacitor voltage due to charging and discharging is called ripple voltage. Generally, ripple is undesirable, thus the smaller the ripple, the better the filtering action.
- Ripple factor is an indication of the effectiveness of the filter and is defined as

$$R = \frac{V_{rms}}{V_{dc}}$$

where $V_{rms} = Ripple.Voltage$ and $V_{dc} = Peak.Rectified.Voltage$

- The ripple factor can be lowered by increasing the value of the filter capacitor or increasing the load capacitance.

Mathematical Analysis:

Let is the input AC signal, the current I_{ac} flows only for one half cycle Therefore from ωt = 0 to ωt = π,

$I_{ac} = I_m sinw_m t$

where Im= maximum value of current

Vm= maximum value of voltage and the current is zero from ωt =π to ωt = 2π

Average or DC value of Voltage:

$$V_{dc} = V_m/_\Pi$$

RMS value of Voltage:

$$V_{rms} = V_m/_2$$

Ripple factor or Rectification Factor:

$$\Upsilon = \sqrt{\left(V_{rms}^2/V_{dc}^2\right) - 1}$$

Peak Inverse Voltage (PIV):

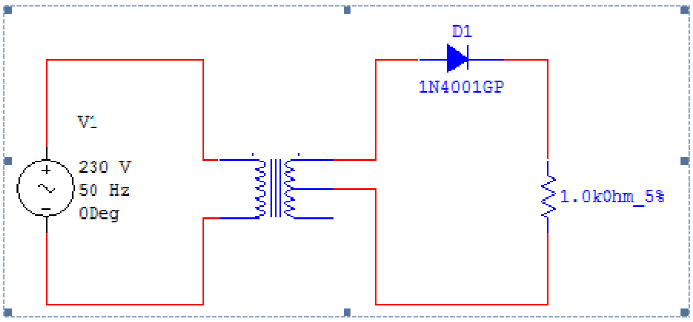
- It is the maximum voltage that has to be with stood by a diode when it is reverse biased.

Rectification Efficiency, η

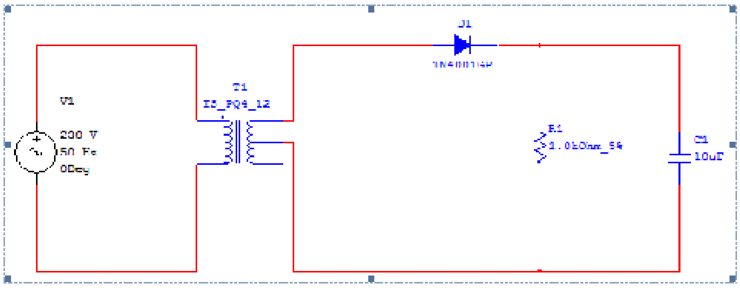
η = P_{ac}/P_{dc}

Circuit Diagram:

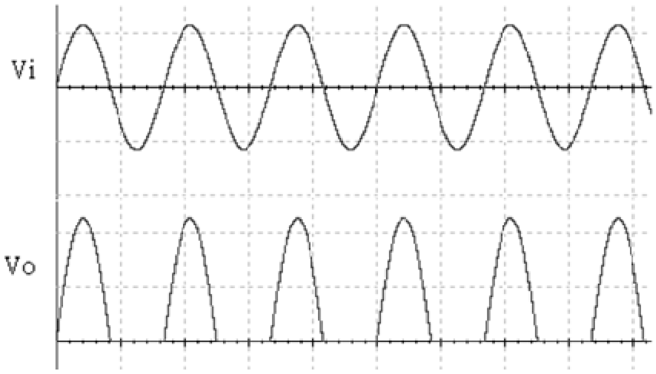
Half Wave Rectifier without Filter



Half Wave Rectifier with Filter



Model Graph:

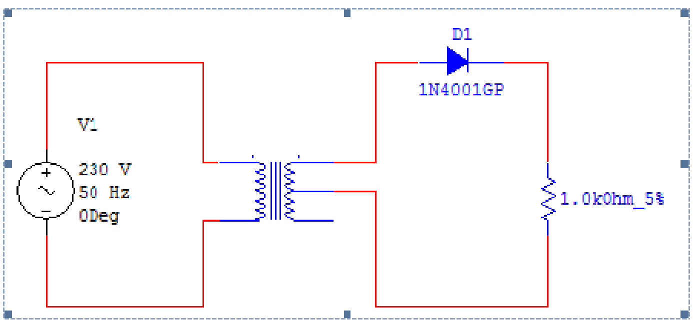


Half-Wave-Rectifier_ -- Procedures

Step 1

- Connections are given as per the circuit diagram without capacitor.

Half Wave Rectifier without Filter



Step 2

- Now connect the capacitor in parallel with load resistor.

Step 3

Tabulate the readings of Halfwave rectifier without filter below.

Rectifier without filter

S.No	Vm	V_{dc}	V_{rms}	factor	Effciency

Step 4

Tabulate the readings of Halfwave rectifier with filter below.

Rectifier with Filter

S.No	Vm	Vdc	$Vrms$	Ripple factor	Effciency

Step 5

Result and Inference:

The circuit behaviour of Halfwave Rectifier is analyzed. The input and output waveforms are observed. The ripple factor and efficieny are evaluated.