SNS COLLEGE OF ENGINEERING

Kurumbapalayam (Po), Coimbatore – 641 107

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Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai

DEPARTMENT OF COMPUTER SCIENCE AND DESIGN

COURSE NAME : 19EE01 BASIC ELECTRICAL AND ELECTRONICS ENGINEERING

I YEAR /II SEMESTER - COMPUTER SCIENCE AND DESIGN

Unit 4 – ANALOG ELECTRONICS

Topic 6 : Half wave Rectifiers

Half-wave rectifiers transform AC voltage to DC voltage. A halfwave rectifier circuit uses only one diode for the transformation. A halfwave rectifier is defined as a type of rectifier that allows only one-half cycle of an AC voltage waveform to pass while blocking the other half cycle. In this session, let us know in detail about the half-wave rectifier.
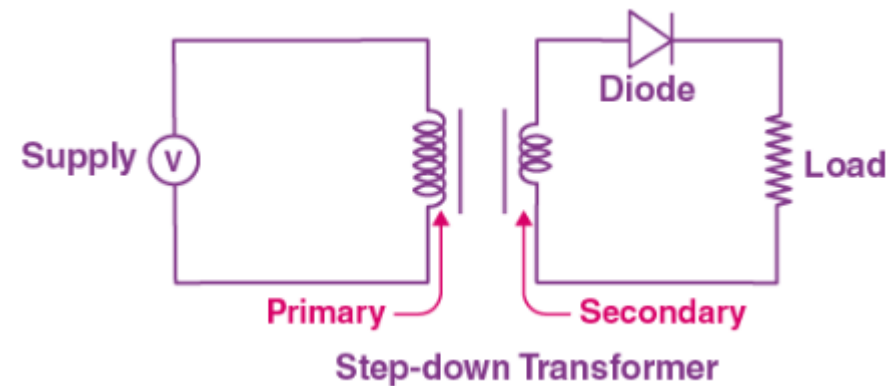
Half Wave Rectifier Circuit

A half-wave rectifier is the simplest form of the rectifier and requires only one diode for the construction of a halfwave rectifier circuit.
A halfwave rectifier circuit consists of three main components as follows:
•A diode
•A transformer
•A resistive load

**Given below is the half-wave rectifier diagram:**

Working of Half Wave Rectifier

In this section, let us understand how a half-wave rectifier transforms AC into DC.

1. A high AC voltage is applied to the primary side of the step-down transformer. The obtained secondary low voltage is applied to the diode.
2. The diode is forward biased during the positive half cycle of the AC voltage and reverse biased during the negative half cycle.
3. The final output voltage waveform is as shown in the figure below:
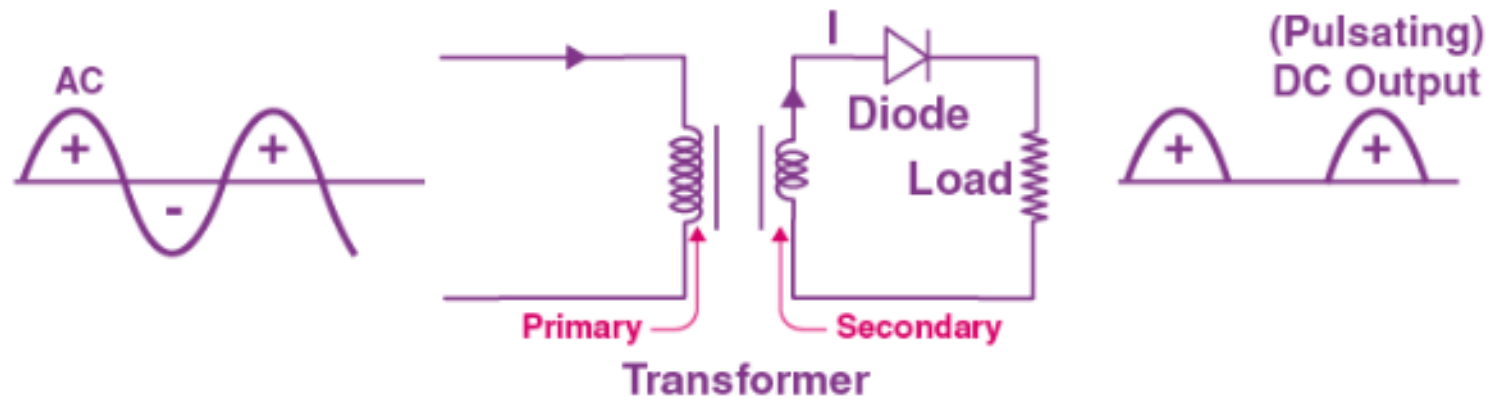
For better understanding, let us simplify the half-wave circuit by replacing the secondary transformer coils with a voltage source as shown below:
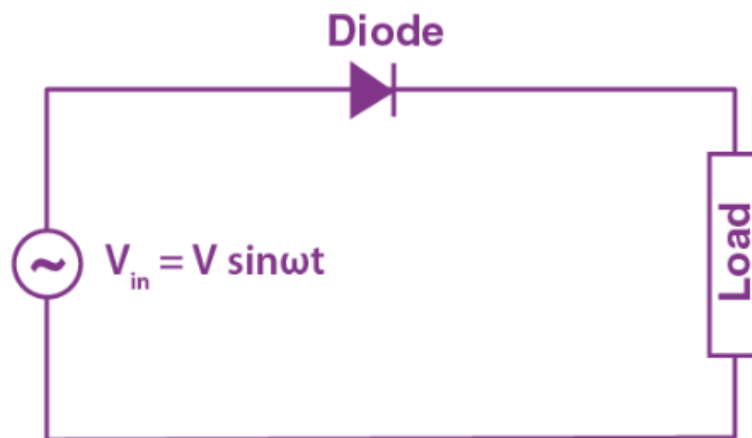
For the positive half cycle of the AC source voltage, the circuit effectively becomes as shown below in the diagram:

When the diode is forward biased, it acts as a closed switch. But, during the negative half cycle of the AC source voltage, the equivalent circuit becomes as shown in the figure below

When a diode is reverse biased, it acts as an open switch. Since no current can flow to the load, the output voltage is equal to zero.
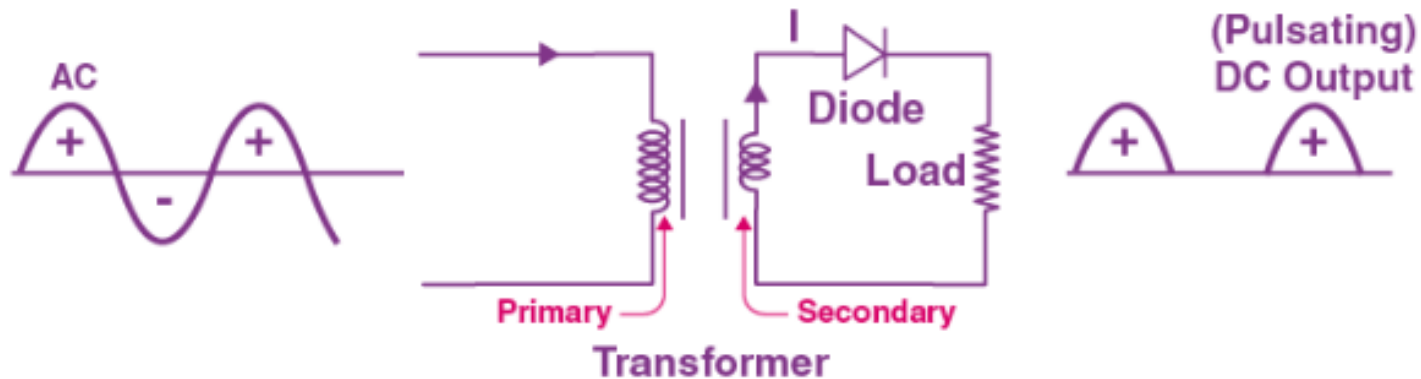
Half Wave Rectifier Waveform
The halfwave rectifier waveform before and after rectification is shown below in the figure.
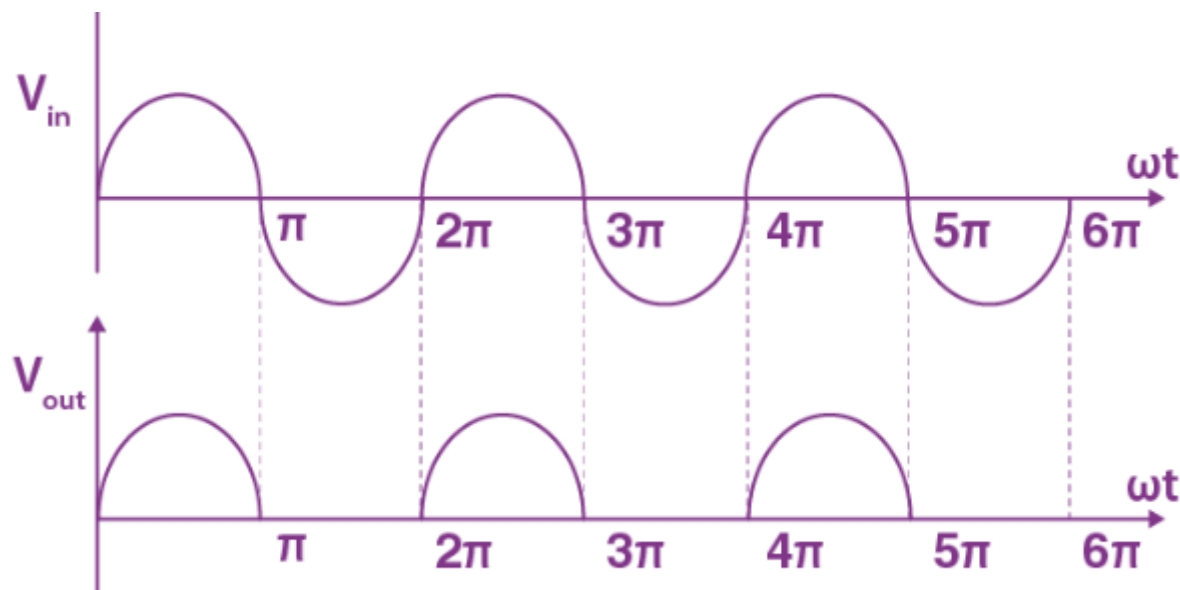
Half Wave Rectifier Capacitor Filter

The output waveform of a halfwave rectifier is a pulsating DC waveform. Filters in halfwave rectifiers are used to transform the pulsating waveform into constant DC waveforms. A capacitor or an inductor can be used as a filter.

The circuit diagram below shows how a capacitive filter is used with halfwave rectifier to smoothen out a pulsating DC waveform into a constant DC waveform.

Half Wave Rectifier Formula

Ripple Factor of Half Wave Rectifier

Ripple factor determines how well a halfwave rectifier can convert AC voltage to DC voltage.
Ripple factor can be quantified using the following formula:

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

The ripple factor of a halfwave rectifier is 1.21.

Efficiency of Halfwave Rectifier

The efficiency of a halfwave rectifier is the ratio of output DC power to the input AC power.
The efficiency formula for halfwave rectifier is given as follows;

$$\eta = \frac{P_{DC}}{P_{AC}}$$

RMS value of Half Wave Rectifier

The RMS value of the load current for a half-wave rectifier is given by the formula:

$$I_{rms} = \frac{I_m}{2}$$

Form factor of a Halfwave Rectifier

The form factor is the ratio between RMS value and average value and is given by the formula:

$$\text{Form Factor} = \frac{\text{RMS Value}}{\text{Average Value}}$$

Applications of Half Wave Rectifier

Here are a few common applications of half wave rectifiers:

• They are used for signal demodulation purpose

• They are used for rectification applications

• They are used for signal peak applications

Disadvantages of Half Wave Rectifier

• Power loss

• Low output voltage

• The output contains a lot of ripples

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THANK YOU