ECE132: Basic Electrical and Electronics Engineering Lab

Experiment 6:

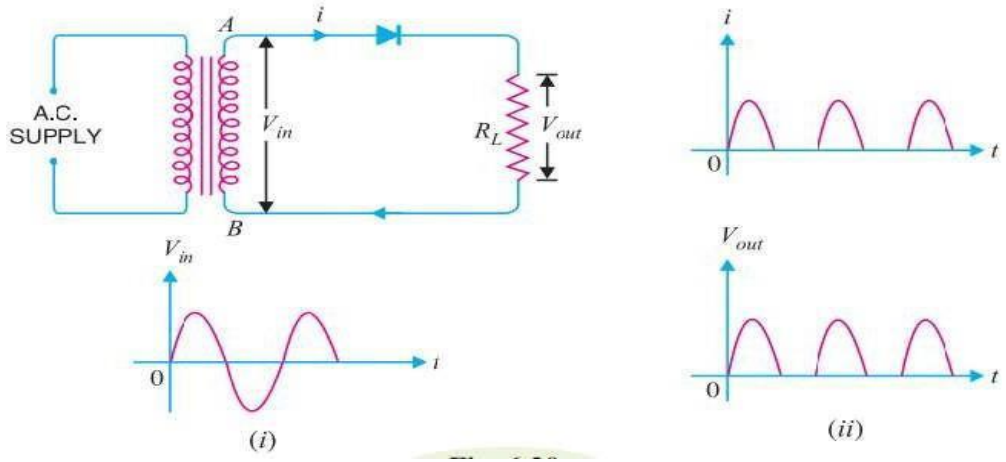
To understand use of diodes for half wave and full wave rectifiers

Introduction

- A rectifier is an electrical device that converts alternating current (AC), which periodically reverses direction, to direct current (DC), which is in only one direction, a process known as rectification.
- We can classify rectifiers into two types:
  - Half Wave Rectifier
  - Full Wave Rectifier

Half Wave Rectifier

- In half wave rectification, either the positive or negative half of the AC wave is passed, while the other half is blocked.
- Because only one half of the input waveform reaches the output, it is very inefficient if used for power transfer.



Half Wave Rectifier

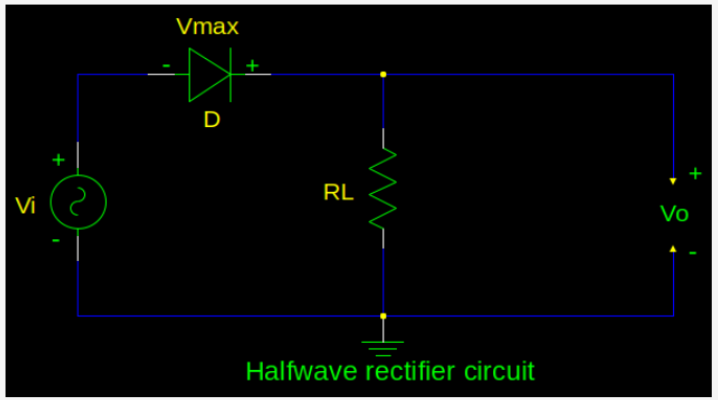
- The output DC voltage of a half wave rectifier can be calculated with the following two ideal equations

$$V_{rms} = \frac{V_{peak}}{2}$$

$$V_{dc} = \frac{V_{peak}}{\pi}$$

Half Wave Rectifier

Halfwave Rectifier Experiment



Instructions

1. Observe the circuit diagram of the fullwave rectifier
2. Click on the **Power** Button.
3. Select the Amplitide(A) of the input sine wave signal(V_i).
4. Select the frequency of the signal(f) for the input signal(V_i).
5. Select the "Channel 1" to observe the input signal on graph
6. Select the "Channel 2" to observe the rectified output signal on graph
7. Select the "Dual" to observe the input signal and rectified output signal on graph
8. Change the values of A, f to observe the variation in the input and output signals.
9. Hover on the graph to observe the value of the V_i and V_o at that instatnt of time T.
10. Save the graph if you are done with your experiment.
11. **Note:**
    - **Ideal diode is considered**
    - **Make sure always Input Signal Amplitude>0 v**
    - **Make sure always Input Signal Frequency>0 Hz**
    - **Load resistance** $R = 1k\Omega$
    - **To change the values just scroll by hovering on it.**

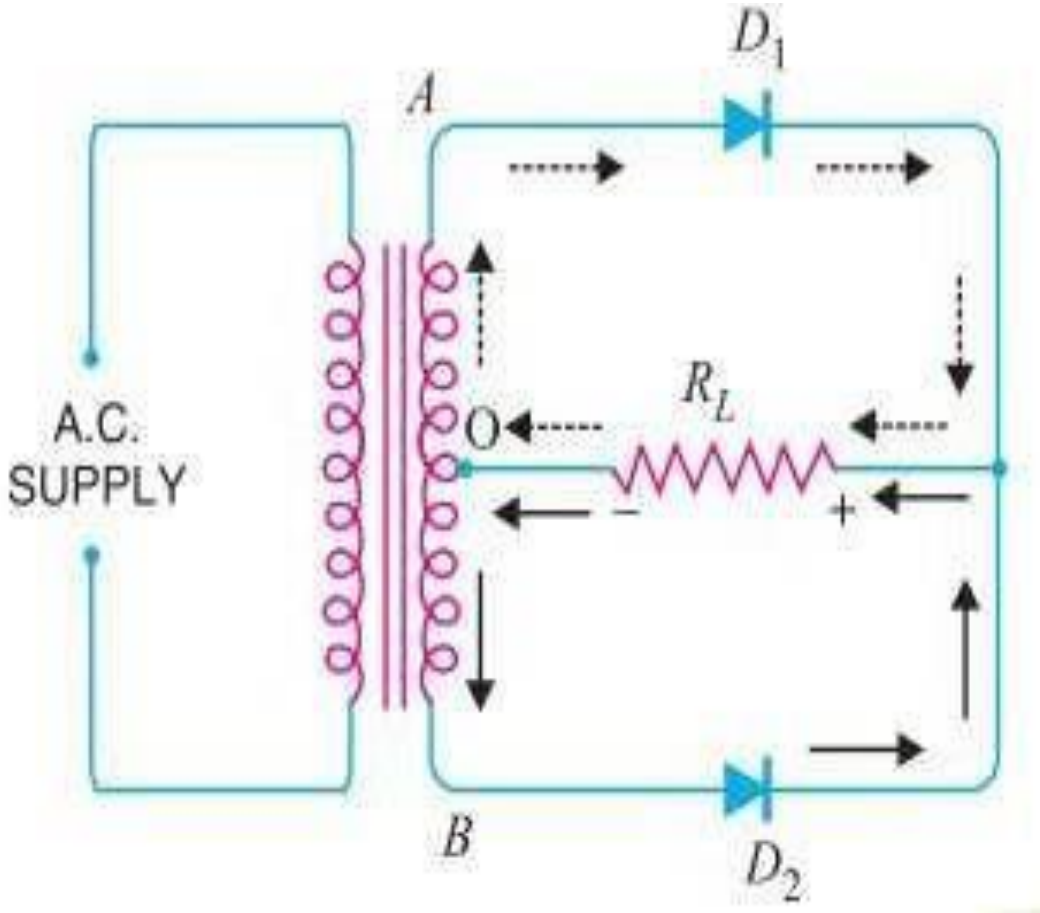
Full Wave Rectifier

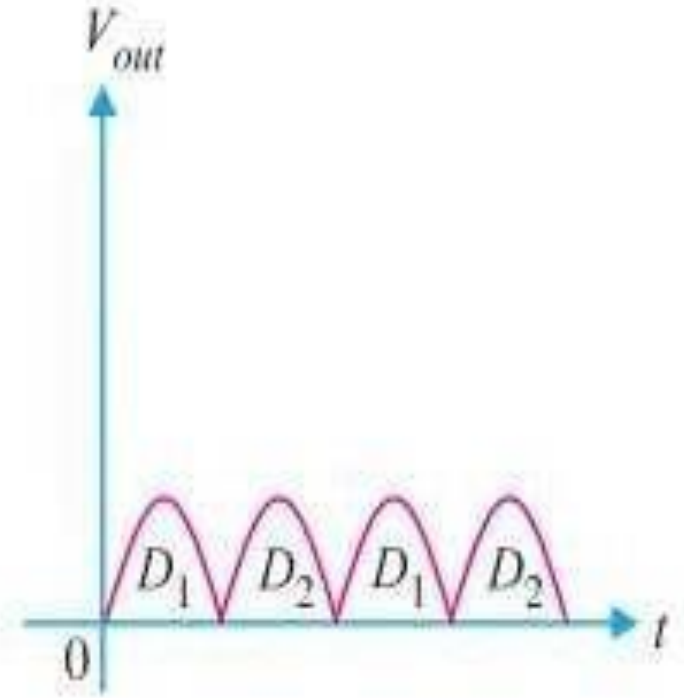
- In Full wave rectification current flow through the load in same direction for both half cycle of input ac.
- This can be achieved with two diodes working alternatively.
- For one half cycle one diode supplies current to load and for next half cycle another diode works

Full Wave Rectifier

- For single-phase AC, if the transformer is **center-tapped**, then two diodes back-to-back (i.e. anodes-to-anode or cathode-to-cathode) can form a full-wave rectifier.
- In a circuit with a **non - center tapped** transformer, four diodes are required instead of the one needed for halfwave rectification, it is also known as bridge rectifier.

Full Wave Rectifier – Center Tapped T/F





Full Wave Rectifier – Center Tapped T/F

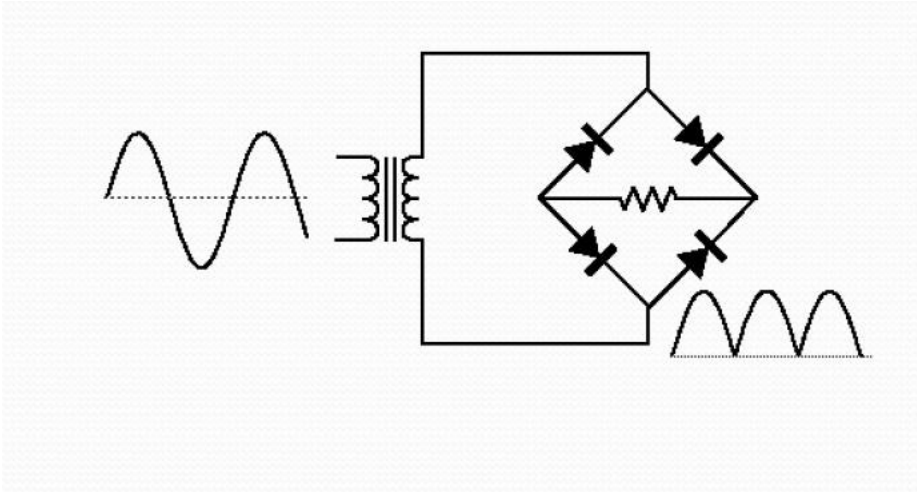
- The average and root-mean-square output voltages of an ideal single phase full wave rectifier can be calculated as:

$$V_{dc} = V_{av} = \frac{2V_p}{\pi}$$

$$V_{rms} = \frac{V_p}{\sqrt{2}}$$

Full Wave Rectifier – Bridge Rectifier

- A bridge rectifier makes use of four diodes in a bridge arrangement to achieve full-wave rectification.



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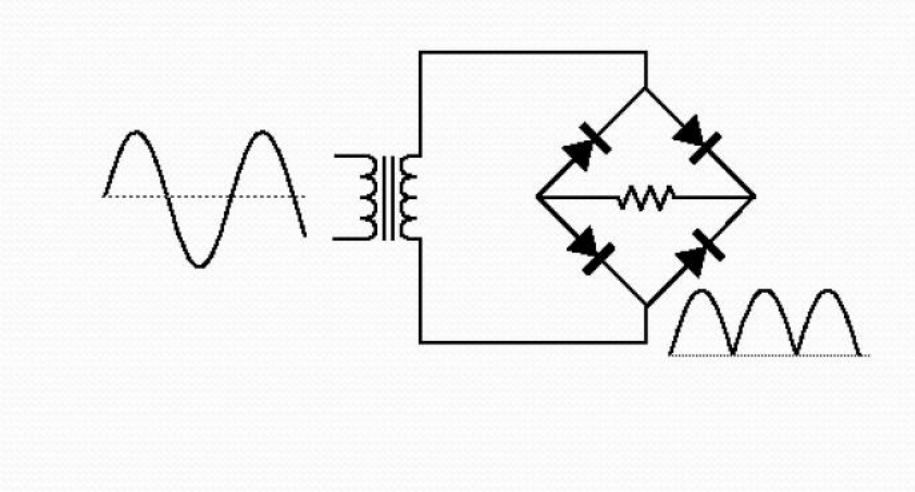
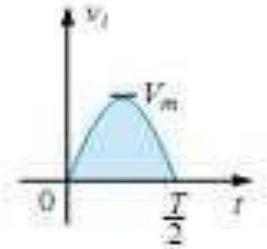
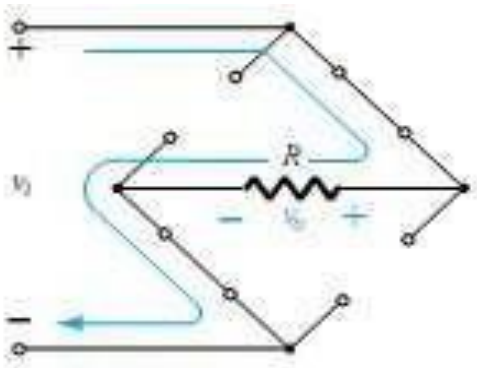
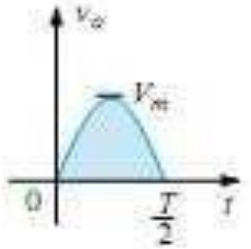
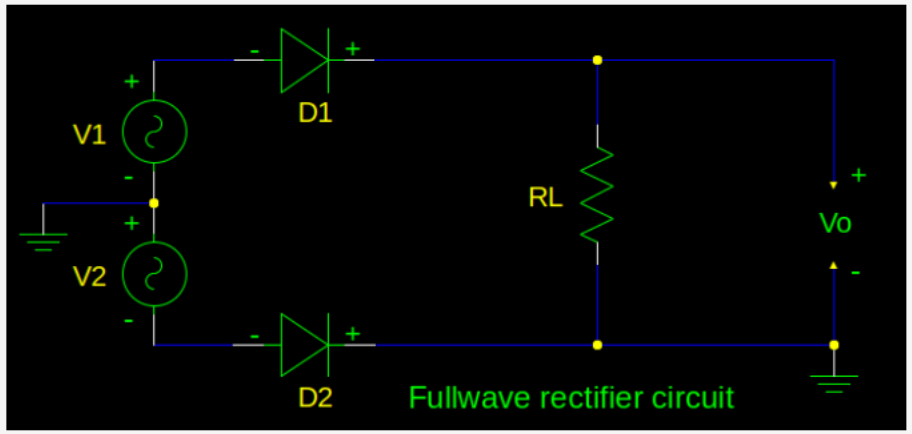








Full Wave Rectifier



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9. Hover on the graph to observe the value of the V_i and V_o at that instatnt of time T.
10. Save the graph if you are done with your experiment.
11. **Note:**
    - **V_2 is 180° in phase to V_1**
    - **Ideal diode is considered**
    - **Make sure always Input Signal Amplitude>0 v**
    - **Make sure always Input Signal Frequency>0 Hz**
    - **Load resistance $R = 1k\Omega$**
    - **To change the values just scroll by hovering on it.**

THANKS TO ALL