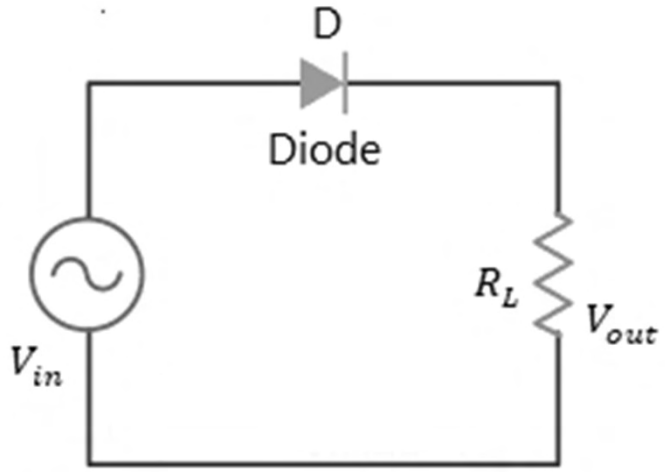
# ANALOG ELECTRONICS CIRCUIT
# ESC301
# Credit: 3

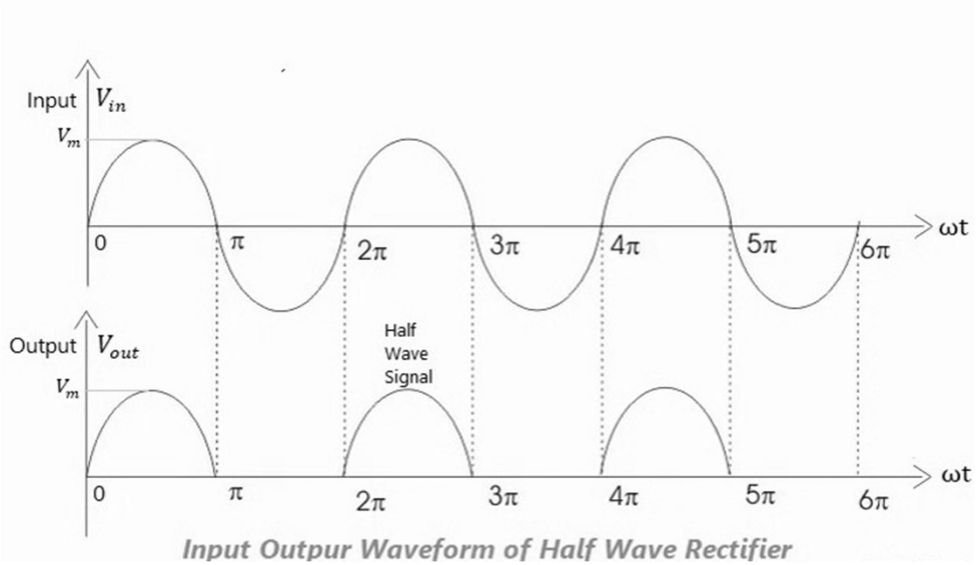
# RECTIFIER

- Rectifier circuit converts AC to DC; the process is known as rectification
- Types of rectifier
  - Half wave rectifier
  - Full wave rectifier

# Half Wave Rectifier

- Converts only one-half of the AC input signal to DC output signal.
- Conducts only the positive half cycle of the input AC signal.
- Negative half cycle is suppressed or clipped.
- Therefore, current always flows in one direction through the load after every half-cycle.




*Input Outpur Waveform of Half Wave Rectifier*

- During the positive half-cycle of input A.C. voltage, the diode is forward biased and hence it conducts current.
- During the negative half-cycle, the diode is reverse biased and it conducts no current.
- Therefore, current flows through the diode during positive half-cycles of input A.C. voltage only; it is blocked during the negative half-cycles. In this way, current flows through load $R_L$ always in the same direction. Hence D.C. output is obtained across $R_L$.
- It may be noted that output across the load is *pulsating D.C*. These pulsations in the output are further smoothened with the help of filter circuits discussed later.

# Disadvantages of Half Wave Rectifier

- Power is delivered only for one-half of the cycle; therefore, power output is low.
- The DC output power thus produced is not sufficient to make general power supply.
- The pulsating current in the load contains alternating component whose basic frequency is equal to the supply frequency. Therefore, an elaborate filtering is required to produce steady direct current.

# Output frequency of Half Wave Rectifier

- Output frequency is equal to input frequency.
- $f_{out}=f_{in}$

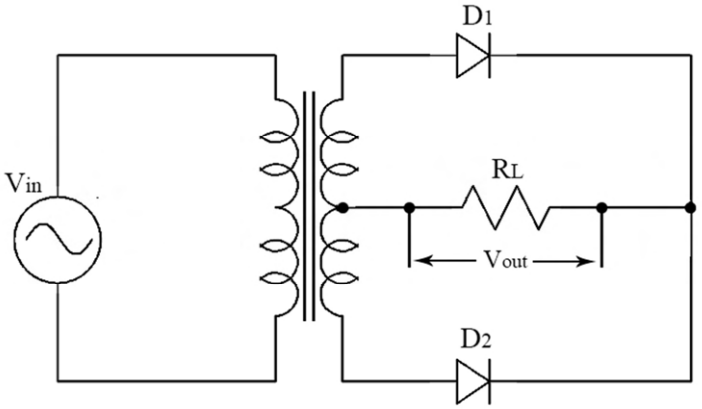
# Full Wave Rectifier

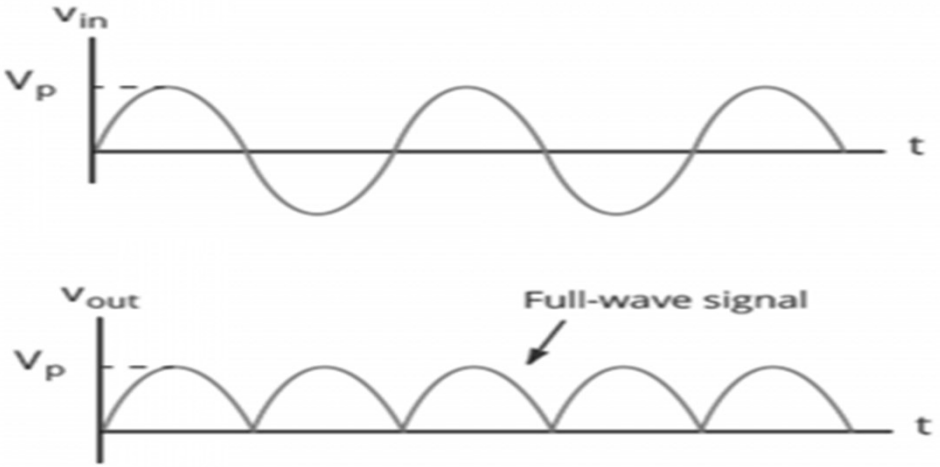
- Both half of the input AC signal is passed to the load but they have the same direction.
- Two diodes are put into use alternatingly.
- Each half cycle activates only one of the two diodes.
- In full-wave rectification, current flows through the load in the same direction for both half-cycles of input A.C. voltage. This can be achieved with two diodes working alternately.
- For the positive half- cycle of input voltage, one diode supplies current to the load and for the negative half-cycle, the other diode does so ; current being always in the same direction through the load.
- Therefore, a full-wave rectifier utilizes both half-cycles of input A.C. voltage to produce the D.C. output.

The following two circuits are commonly used for full-wave rectification: -

(i) Centre-tap full-wave rectifier (ii) Full-wave bridge rectifier

# Full Wave Rectifier




Centre Tapped Full wave Rectifier

# Output frequency of Full Wave Rectifier

- Output frequency is equal to double of input frequency.
- $f_{out} = 2 f_{in}$

# Full Wave Rectifier- Centre Tapped

- Two diodes are present with centre tap transformer.
- D1 conducts in positive half; D2 conducts in negative half of the input signal.
- Current through load has same direction for both cycle.
- It may be seen that current in the load RL is in the same direction for both half-cycles of input A.C. voltage. Therefore, D.C. is obtained across the load RL.

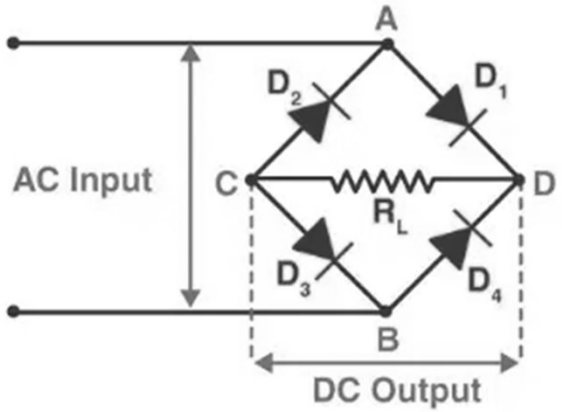
# Advantages of Full Wave Rectifier- Centre Tapped

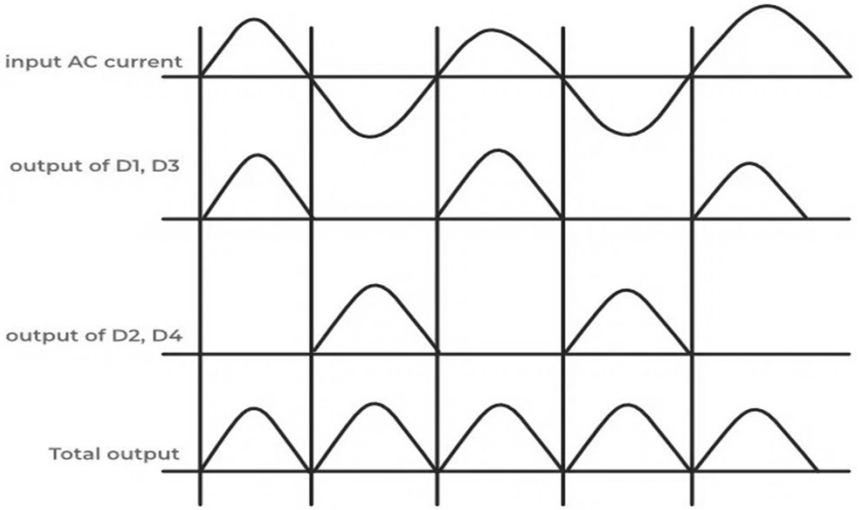
- The D.C. output voltage and load current values are twice than that of a half wave rectifier.
- The ripple factor is much less (0.482) than that of half rectifier (1.21).
- The efficiency is twice (81.2%) than that of half wave rectifier (40.6%).

# Disadvantages of Full Wave Rectifier- Centre Tapped

- It is difficult to locate the centre tap on the secondary winding.
- The D.C. output is small as each diode utilizes only one-half of the transformer secondary voltage.
- The diodes used must have high peak inverse voltage.

# Full Wave Rectifier- Bridge Rectifier




waveforms-of-bridge-rectifier

- Four diodes are present which form a bridge.
- D1 and D3 conducts in first half while D2 and D4 are off.
- D2 and D4 conducts in second half while D1 and D3 are off.
- Current through load has same direction for both cycle.