Rectification

The process of converting alternating current into direct current is called rectification. In this section, we will discuss two types of rectifiers namely, half wave rectifier and full wave rectifier.

1. Half wave rectifier circuit

The half wave rectifier circuit is shown in Figure 9.17(a). The circuit consists of a transformer, a p-n junction diode and a resistor. In a half wave rectifier circuit, either a positive half or the negative half of the AC input is passed through while the other half is blocked. Only one half of the input wave reaches the output. Therefore, it is called half wave rectifier. Here, a p-n junction diode acts as a rectifier diode.

During the positive half cycle

When the positive half cycle of the ac input signal passes through the circuit, terminal A becomes positive with respect to terminal B. The diode is forward biased and hence it conducts. The current flows through the load resistor R_L and the AC voltage developed across R_L constitutes the output voltage V_0 and the waveform of the diode current is shown in Figure 9.17(b).

During the negative half cycle

When the negative half cycle of the ac input signal passes through the circuit, terminal A is negative with respect to terminal B. Now the diode is reverse biased and does not conduct and hence no current passes through R_L. The reverse saturation current in a diode is negligible. Since there is no voltage drop across R_L, the negative half cycle of ac supply is suppressed at the output. The output waveform is shown in Fig.

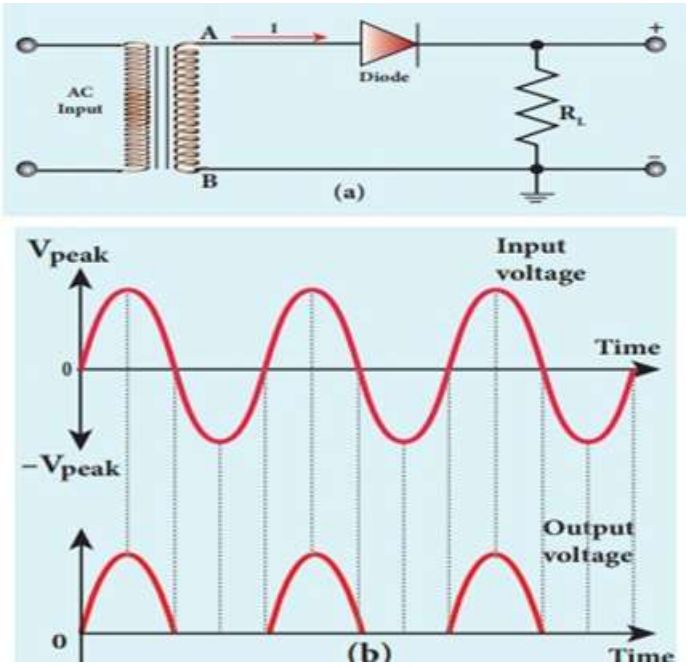

Figure 1.4.1 Half wave rectifier

Diagram Source Brain Kart

The output of the half wave rectifier is not a steady dc voltage but a pulsating wave. This pulsating voltage can not be used for electronic equipments. A constant or a steady voltage is required which can be obtained with the help of filter circuits and voltage regulator circuits.

Efficiency (η) **is the ratio of the output dc power to the ac input power supplied to the circuit**. Its value for half wave rectifier is 40.6 %

Full wave rectifier

The positive and negative half cycles of the AC input signal pass through the full wave rectifier circuit and hence it is called the full wave rectifier. The circuit is shown in Figure 9.18(a). It consists of two p-n junction diodes, a center tapped transformer, and a load resistor (RL) .

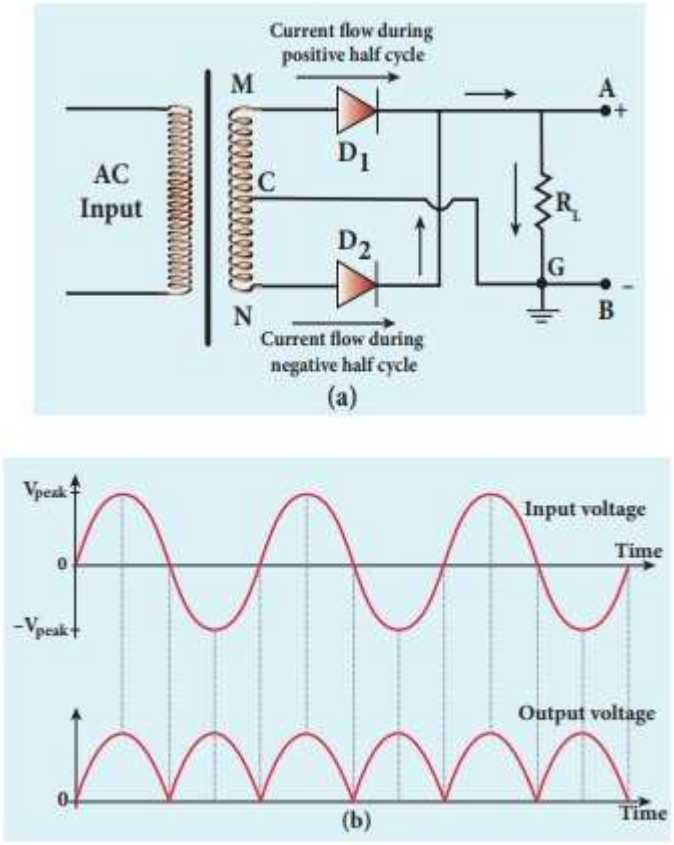

Figure 9.18 (a) Full wave rectifier circuit (b) Input and output waveforms

Figure 1.4.2 Full Wave rectifier

Diagram Source Brain Kart

The centre is usually taken as the ground or zero voltage reference point. Due to the centre tap transformer, the output voltage rectified by each diode is only one half of the total secondary voltage.

During positive half cycle

When the positive half cycle of the ac input signal passes through the circuit, terminal M is positive, G is at zero potential and N is at negative potential. This forward biases diode D_1 and reverse biases diode D_2. Hence, being forward biased, diode D_1 conducts and current flows along the path MD_1AGC. As a result, positive half cycle of the voltage appears across R_L in the direction G to C

During negative half cycle

When the negative half cycle of the ac input signal passes through the circuit, terminal N is positive, G is at zero potential and M is at negative potential. This forward biases diode D_2 and reverse biases diode D_1. Hence, being forward biased, diode D_2 conducts and current flows along the path *ND_2 BGC*. As a result, negative half cycle of the voltage appears across R_L in the same direction from G to C.

Hence in a full wave rectifier both postive and negative half cycles of the input signal pass through the load in the same direction as shown in Figure 9.18(b). Though both positive and negative half cycles of ac input are rectified, the output is still pulsating in nature.

The efficiency (η) of full wave rectifier is twice that of a half wave rectifier and is found to be 81.2 %. It is because both the positive and negative half cycles of the ac input source are rectified.

Bridge rectifier

A bridge rectifier is shown in Fig. There are four diodes D_1, D_2, D_3 and D_4 used in the circuit, which are connected to form a network. The input ends A and C of the network are connected to the secondary ends S_1 and S_2 of the transformer. The output ends B and D are connected to the load resistance R_L.

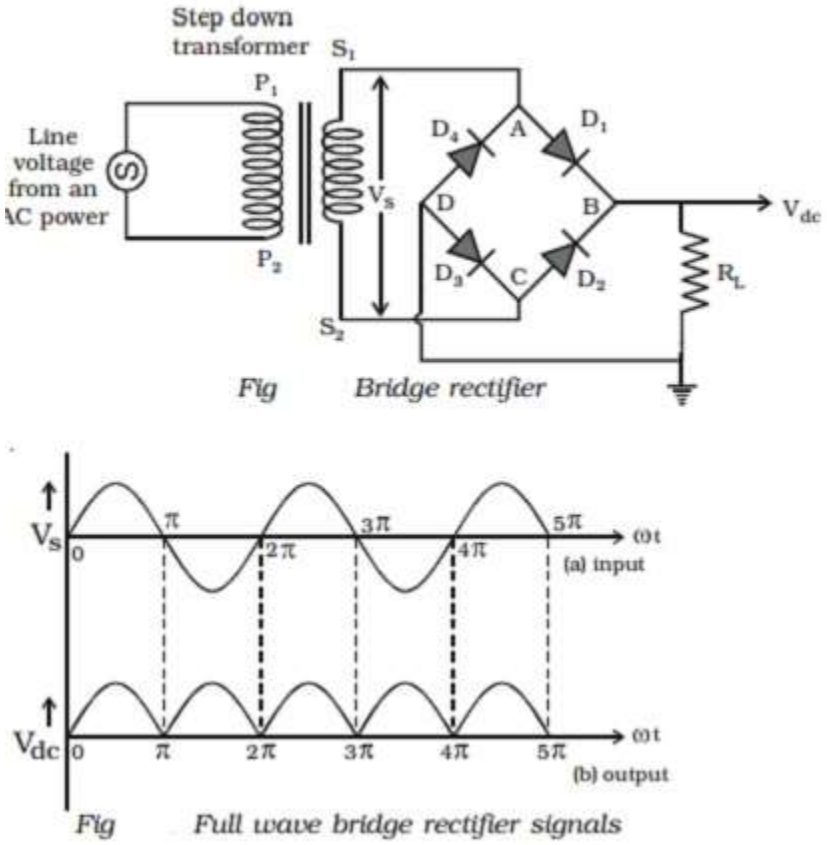

Figure 1.4.3 Bridge rectifier

Diagram Source Brain Kart

During positive input half cycle of the a.c. voltage, the point A is positive with respect to C. The diodes D_1 and D_3 are forward biased and conduct, whereas the diodes D_2 and D_4 are reverse biased and do not conduct. Hence current flows along S_1ABDCS_2 through R_L. During negative half cycle, the point C is positive with respect to A. The diodes D_2 and D_4 are forward biased and conduct, whereas the diodes D_1 and D_3 are reverse biased and they do not conduct. Hence current flows along S_2CBDAS_1 through R_L. The same process is repeated for subsequent half cycles. It can be seen that, current flows through R_L in the same direction, during both half cycles of the input a.c. signals. The output signal corresponding to the input signal is shown in Fig. The efficiency of the bridge rectifier is approximately 81.2%.

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