Experiment No: 03

Name of the Experiment: Diode rectifier circuits.

Objective:

Study of different diode rectifier circuits.

Theory:

A rectifier converts an AC signal into a DC signal. From the characteristic curve of a diode we observe that if allows the current to flow when it is in the forward bias only. In the reverse bias it remains open. So, when an alternating voltage (signal) is applied across a diode it allows only the half cycle (positive half cycle depending on the orientation of diode in the circuit) during its forward bias condition, other half cycle will be clipped off. In the output the load will get DC signal.

Diode rectifier can be categorized in two major types. They are -

1. Half-wave rectifier.
2. Full-wave rectifier.

Half - Wave Rectifier: Half-wave rectifier can be built by using a single diode. The circuit diagram and the wave shapes of the input and output voltage of half wave rectifier are shown bellow (figure 2.1) -

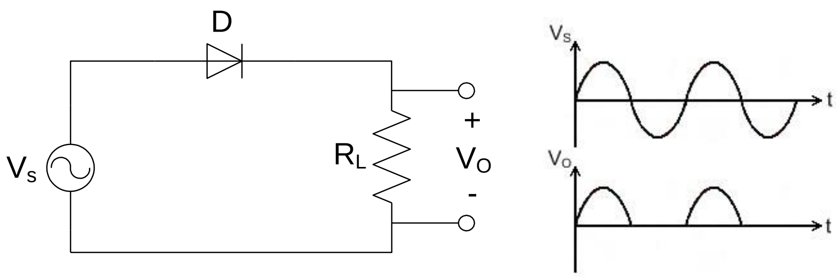

Figure 3.1: Half Wave Rectifier.

The major disadvantages of half wave rectifier are -

- In this circuit the load receives approximately half of input power.
- Average DC voltage is low.
- Due to the presence of ripple output voltage is not smooth one.

Full Wave Rectifier: in the full-wave rectifier both the half cycle is present in the output. Two circuits are used as full-wave rectifier are shown bellow -

a) Full-wave rectifier using center-tapped transformer.
b) Full-wave bridge rectifier.

Full-wave rectifier using center-tapped transformer: two diodes will be connected to the ends of the transformer and the load will be between the diode and center tap. The circuit diagram and the wave shapes are shown in bellow (figure 2.2) -

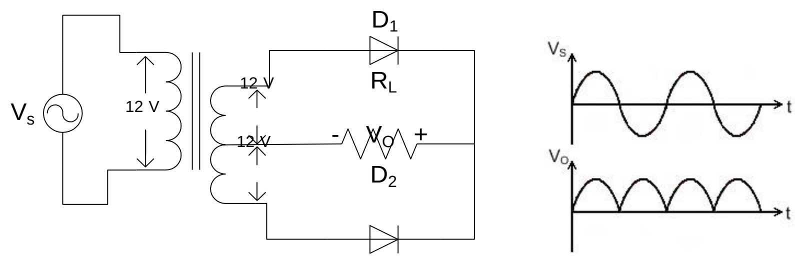

Figure 3.2: Full Wave Rectifier Using Center Tapped Transformer.

Full-wave rectifier using center-tapped transformer circuit has some advantages over full-wave rectifier. Those are -

- Wastage of power is less.
- Average DC output increase significantly.
- Wave shape becomes smoother.

The disadvantages of full-wave rectifier using center-tapped transformer are -

- Require more space and becomes bulky because of the transformer.
- Not cost effective (for using transformer).

Full-wave bridge rectifier: a bridge rectifier overcomes all the disadvantages of described above. Here four diodes will be connected as bridge connection. The circuit diagram and the wave shapes are shown in bellow (figure 2.3) -

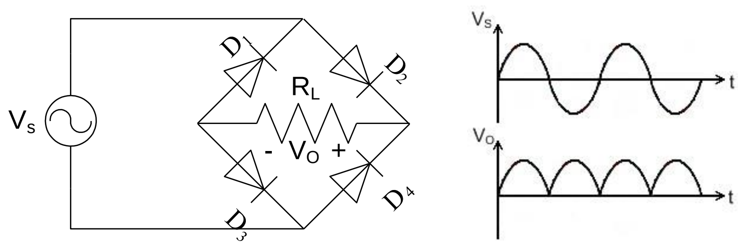

Figure 3.3: Full Wave Bridge Rectifier.

This rectifier however cannot produce a smooth DC voltage. It produces some ripple in the output. This ripple can be reducing by using filter capacitor across the load.

Equipments And Components:

Serial no.	Component Details	Specification	Quantity
1.	p-n junction diode	1N4007	4 piece
2.	Resistor	10KΩ	1 piece
3.	Capacitor	0.22μF, 10μF	1 piece each
4.	Signal generator		1 unit
5.	Trainer Board		1 unit
6.	Oscilloscope		1 unit
7.	Digital Multimeter		1 unit
8.	Chords and wire		as required

Experimental Setup:

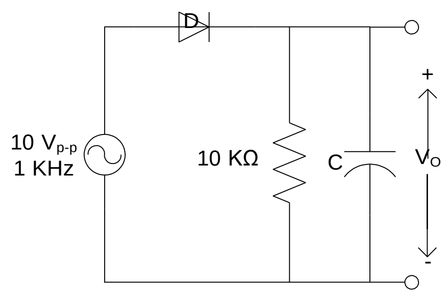

Figure 3.4 : Experimental Circuit 1.

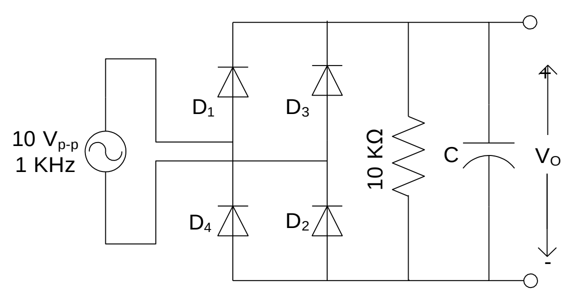

Figure 3.5 : Experimental Circuit 2.

Procedure:

1. Connect the circuit in breadboard as shown in figure 2.4 without capacitor.
2. Observe the output and input voltages in the oscilloscope and draw them.
3. Connect the 0.22μF capacitor and repeat step 2.
4. Connect the 10μF capacitor and repeat step 2. How does the output wave-shape differ from that in step 3?
5. Vary the frequency from 10 KHz to 100 Hz. What effects do you observe when frequency is changed?
6. Connect the circuit breadboard as shown in figure 2.5 without capacitor.
7. Observe the output and input voltages in the oscilloscope and draw them.
8. Connect the 0.22μF capacitor and repeat step 7.
9. Connect the 10μF capacitor and repeat step 7. How does the output wave-shape differ from that in step 8?
10. Vary the frequency from 10 KHz to 100 Hz. What effects do you observe when frequency is changed?

Report:

1. Write the answers that were asked during the working procedure.
2. Draw the input wave, output wave (without and with capacitor) for both the circuits.
3. What is the effect in output for changing input signal frequency for both the circuits (without and with capacitor)?
4. What is the function of capacitor in the both circuits? Why a capacitor of higher value is preferable?
5. Add the PSPICE simulation waveforms of all the experimental circuits.