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 below (figure 2.1) -

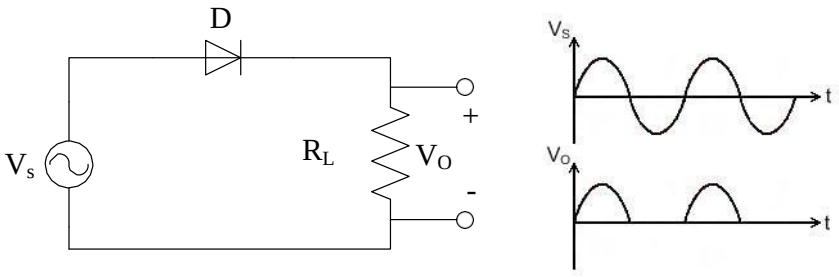


Figure 2.1: Half Wave Rectifier.

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 below -

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 below (figure 2.2) -

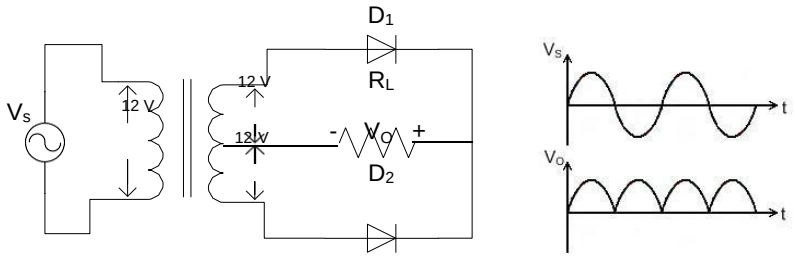


Figure 2.2: Full Wave Rectifier Using Center Tapped Transformer.

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 -

- Requires 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) -

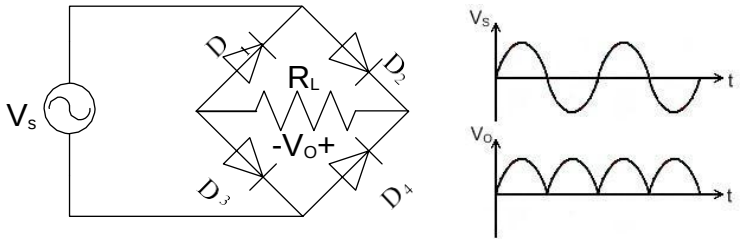


Figure 2.3: Full Wave Bridge Rectifier.

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.

Equipment 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:

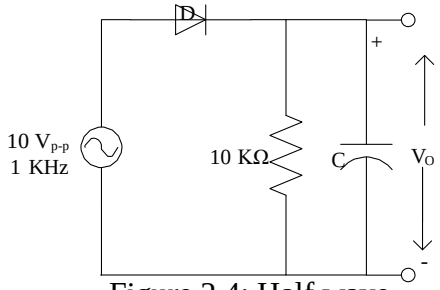


Figure 2.4: Half wave

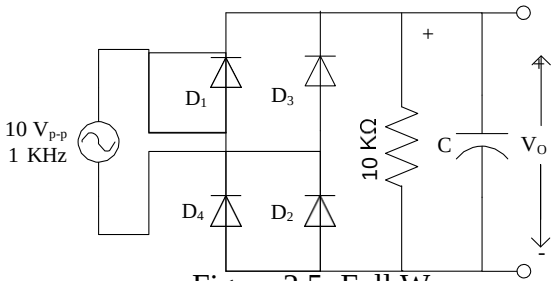


Figure 2.5: Full Wave

Procedure:

1. First, connect the circuit in breadboard as shown in figure 2.4 without any capacitor.
2. Apply 1 KHz 10V (p-p) sinusoidal input signal from signal generator.
3. Connect channel 1 of oscilloscope to the input side, and channel 2 of oscilloscope to output side. Observe the wave shapes and p-p values inputs and outputs and draw them in the graph paper with proper p-p values.
4. Connect the 0.22µF capacitor and repeat step 3. [decrease the Volts/DIV for proper wave-shape]
5. Now keeping capacitor fixed at 0.22 µF, Observe the change in output wave shape by 1st varying the frequency lower than 1 Khz and then higher than 1 khz.
6. Connect the 10µF capacitor and repeat step 3 and step 5. [decrease the Volts/DIV for proper wave-shape]
7. Repeat steps 1-6 for Figure 2.5.

Data Collection:

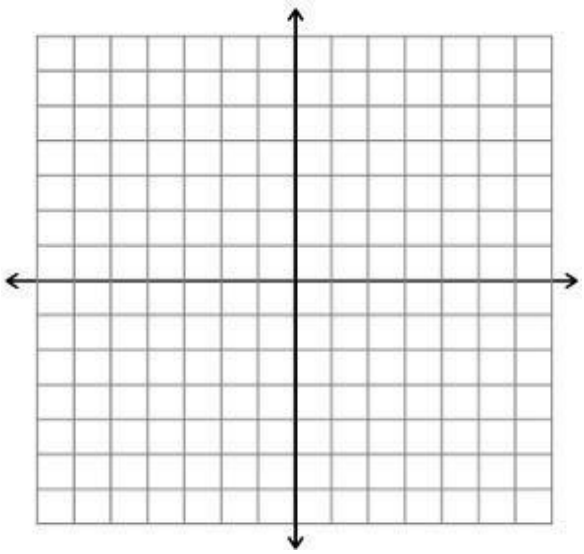
Signature of instructor:

Experiment: 2,
Performed by Group# _____

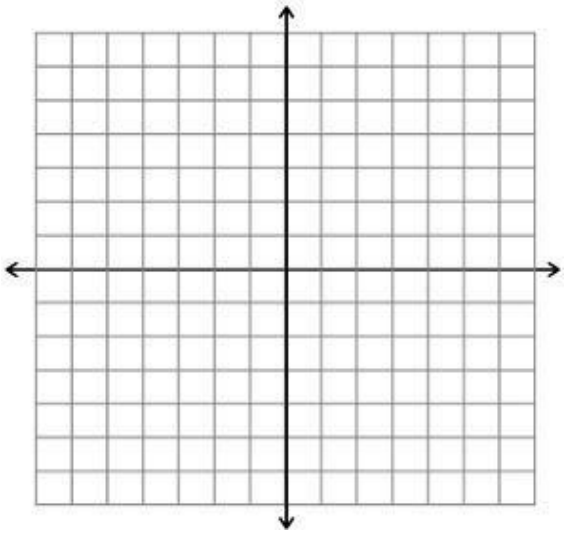
Theoretical value: R = ___

Measured value: R = ____

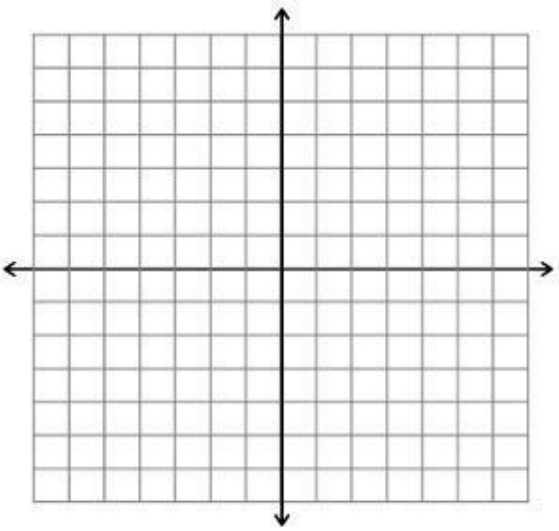
	Half Wave Rectifier (Fig 2.4)	Full wave Rectifier (Fig 2.5)
( ) (without capacitor)		
( ) (with 0.22 µF)		
( ) (with 10 µF)		



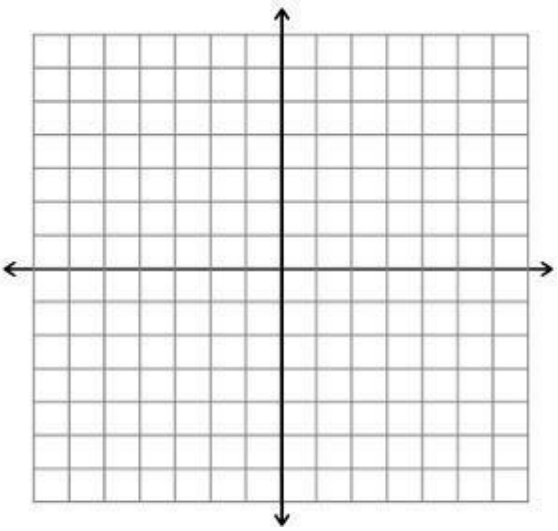
a) Input-output without capacitor (fig 2.4)



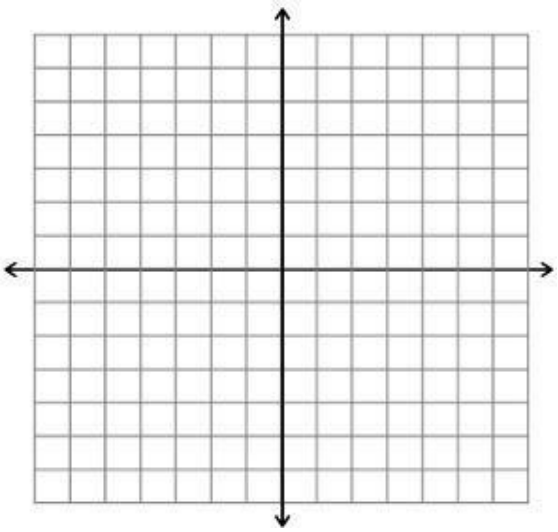
d) Input-output without capacitor (fig 2.5)



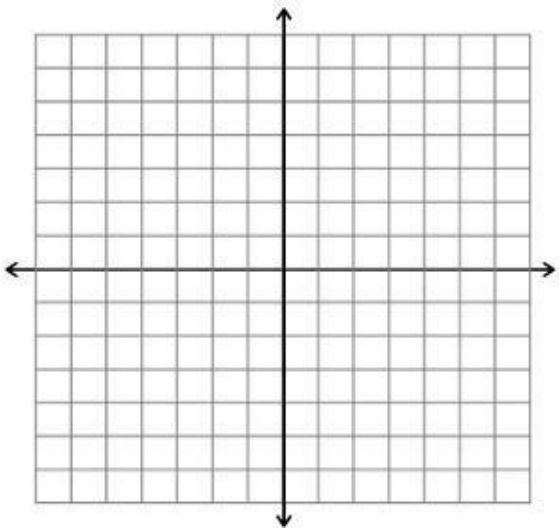
b) Input-output with 0.22uF (fig 2.4)



e) *Input-output with 0.22uF (fig 2.5)*



c) Input-output with 10uF (fig 2.4)



f) *Input-output with 10uF (fig 2.5)*

Report:

1. For Fig 2.4 and Fig 2.5, draw the input-output wave-shape without capacitor, with 0.22µF capacitor and 10µF capacitor.
2. Compare the change in the wave-shape and peak to peak values for no capacitor at the output to 0.22 µF to 10 µF.
3. Explain the effect on the output signal for changing the frequency of the input signal
4. Between half wave and full wave which circuit produces smoother output? Briefly explain in context with your data collection.