Experiment: DIODE CLIPPER CIRCUIT

Aim

a) To be able to design a clipper circuit for a desired clipping value.

b) To construct the circuit on the breadboard

c) To observe output waveforms on the oscilloscope.

d) To calculate the peak values of waveforms for positive and negative cycles

e) To plot input and output waveforms on a graph sheet to scale.

Equipment and Components: Cathode Ray Oscilloscope (CRO), Signal generator, Multimeter, DC power supply, Breadboard, Probes, connecting wires; Diode (e.g., 1N4007), Resistor (R), and Capacitor (C)

Theory: Circuit with which waveforms can be shaped are known as waveshaping circuits. Clipper is a waveshaping circuit which removes a portion of the signal. Clipper circuits are used as limiters/slicers to clip a waveform above/ below a certain level. If the output is measured across the series resistance, then the circuits are called as series clipper circuits. If the output is measured across the diode (and the reference voltage connected to it) is called shunt clipper circuits.

Operation: Consider the input waveform shown in fig. 1. The input waveform is described by (1).

$$V = V_{max} sin(\omega t) \tag{1}$$

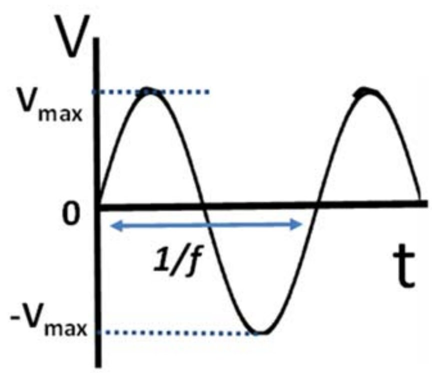

Fig. 1: Input signal waveform

Consider the circuits shown in fig. 2(a). During the positive half cycle, the diode is ON, and the output is close to zero. During the negative half cycle; as the diode is in reverse bias, the entire input appears as output as shown in fig. 2(b). The circuit is called as a positive shunt clipper.

The circuit is shown in fig. 3(a) is called as a negative shunt clipper. During the positive half cycle, as the diode is in the cutoff region, the entire input appears across the output. During the negative half cycle, the diode conducts causing no output. The output waveform is shown in fig. 3(b).

In the circuit shown in fig. 4(a), during the positive half cycle the diode conducts thus a positive reference voltage appears at the output. During the negative half cycle, the entire input is generated as the output as the diode is in reverse biased condition. This circuit is called a positive clipper with a positive reference voltage. The output waveform of the circuit is shown in fig. 4(b). Instead of a positive reference voltage, if a negative voltage reference is added, then the circuit is called a positive clipper with a negative voltage reference.

In the circuit shown in fig. 5(a), a negative reference voltage is connected in series with the diode to form a negative clipper with a negative reference voltage. During the positive half cycle, the entire input appears as output, and during the negative half cycle, the reference voltage appears as output. The output waveform is shown in fig. 5(b). Instead of a negative voltage, if a positive reference voltage is connected to the circuit shown in fig. 5(a), then the circuit is called negative clipper with a positive reference voltage.

In the circuit shown in the fig. 6(a), two diodes D_1 and D_2 are connected in parallel. During the positive half cycle, the diode D_1 conducts causing the cut-in voltage of D_1 to appear across the output. During the negative cycle, the diode D_2 conducts causing the cut-in voltage of D_2 to appear as output. The output waveform is shown in fig. 6(b).

Clamper Circuit	**Output Waveform**
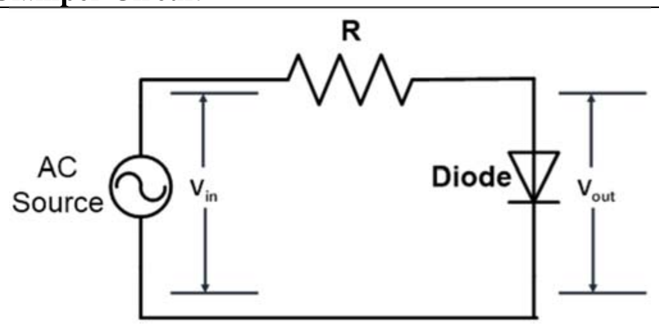	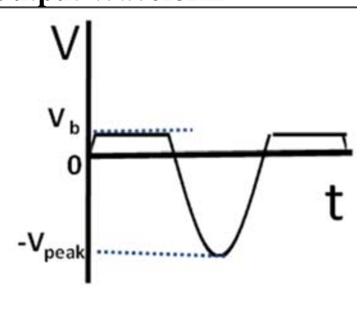
Fig. 2(a)	**Fig. 2(b)**
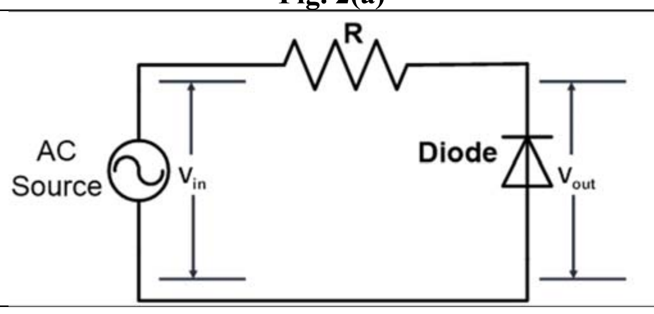	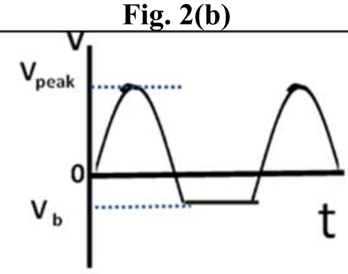
Fig. 3(a)	**Fig. 3(b)**

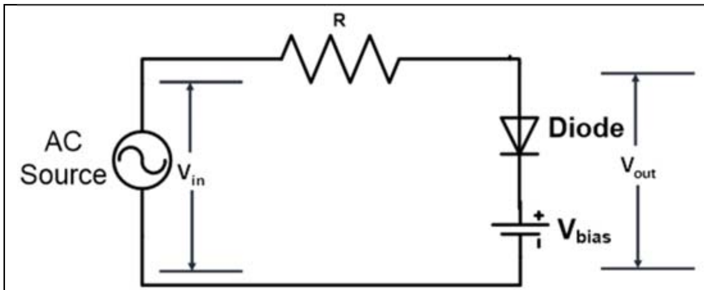

Fig. 4(a)

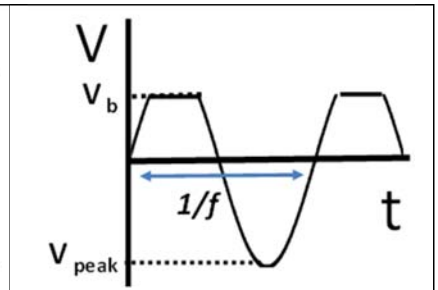

Fig. 4(b)

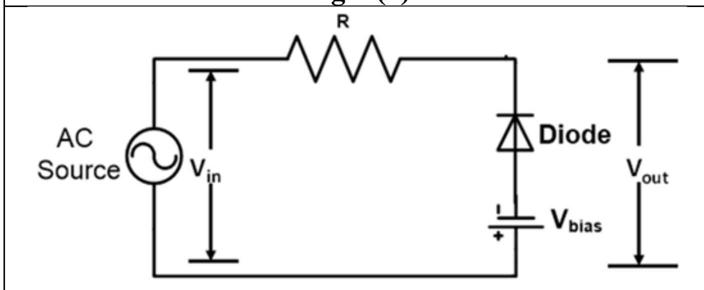

Fig. 5(a)

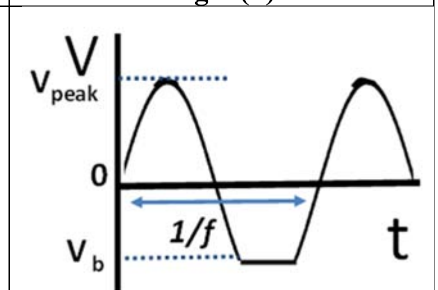

Fig. 5(b)

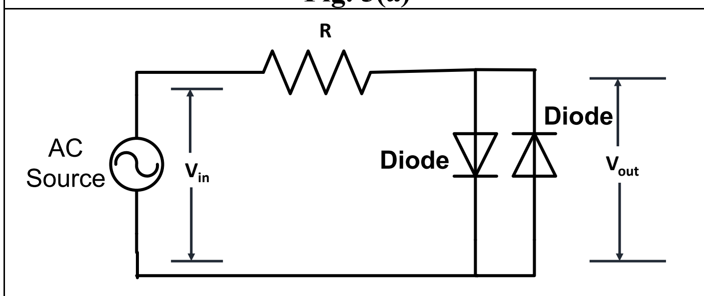

Fig. 6(a)

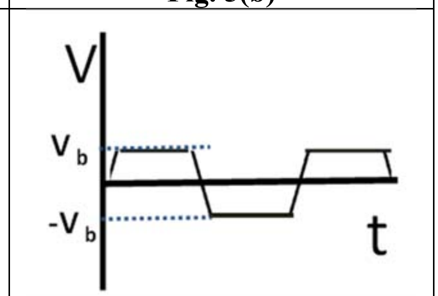

Fig. 6(b)

Experiment Procedure

1. Connect the circuit shown in fig. 2(a) on the breadboard.
2. Apply a sinusoidal signal of a with frequency f and amplitude Vmax using a signal generator. Observe the waveform using an oscilloscope in channel 1. Note the values of the signal and trace the curve on a graph sheet as per scale.
3. Connect the output of the circuit to the second channel of the oscilloscope.
4. Trace the output waveform on the graph sheet as per scale.
5. Draw the input waveform and output waveform on the same graph sheet
6. Using the XY plot, trace the input vs. output on the graph sheet.
7. Repeat steps 1 through 6 for circuits shown in Fig. 3(a), 4(a), 5(a), and 6(a).

Conclusion: