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Experiment No 12
Types of Clippers at Different Reference Voltages

AIM: To study the series and shunt biased and unbiased diode clipper circuits.

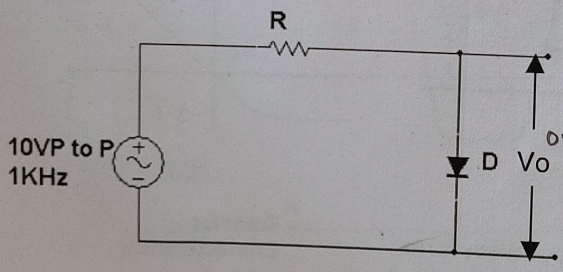
EQUIPMENT & COMPONENTS REQUIRED :

1. Signal generator
2. Cathode ray oscilloscope
3. D.C power supply
4. Bread board
5. Components as per circuit diagram.
6. Probes & connecting wires etc.

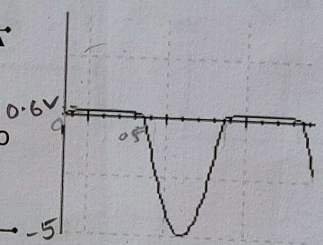
(a) Circuit diagram:

Diode: IN4007 R = 18KΩ

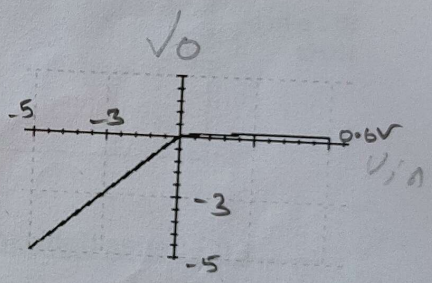
a)Shunt unbiased

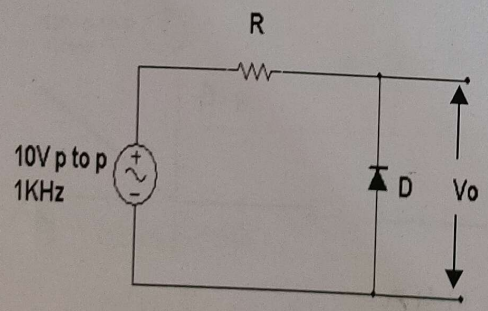


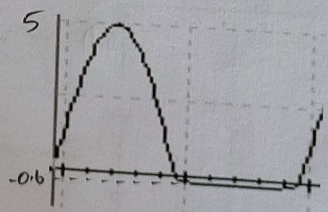
Output Waveform

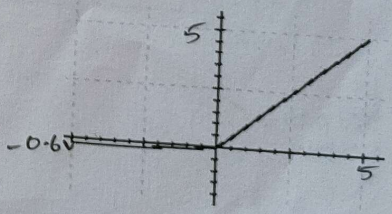


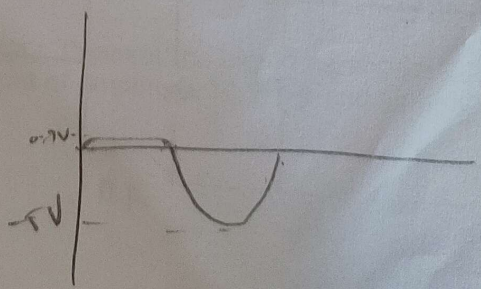
Transfer Characteristics











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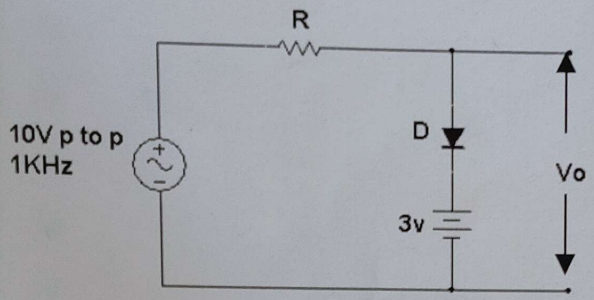
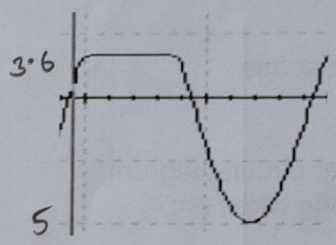
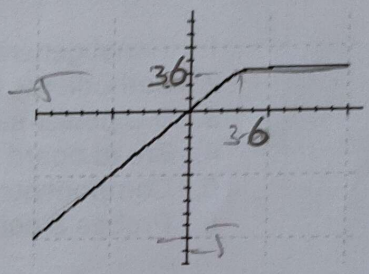
(b) Shunt Biased:

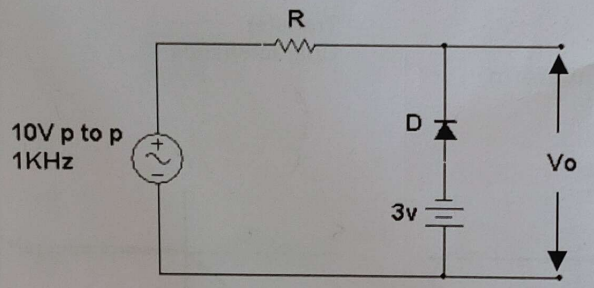
Output Waveform

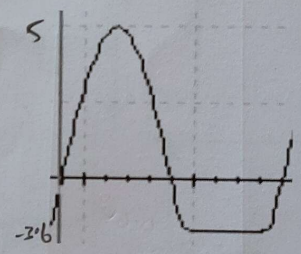
Transfer Characteristics

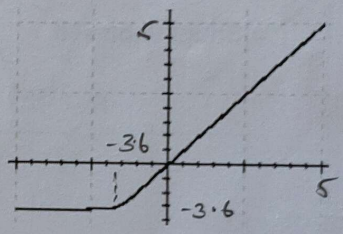








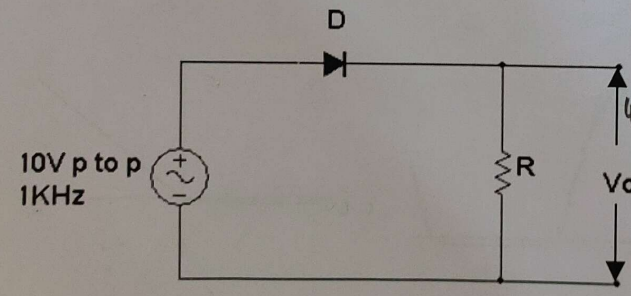


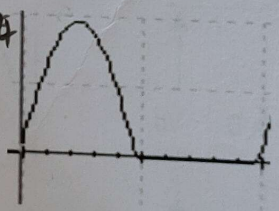


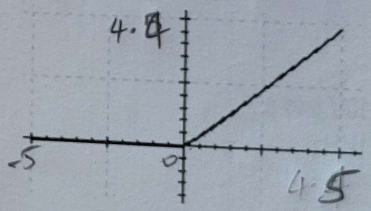
(C) Series Unbiased

Output Waveform

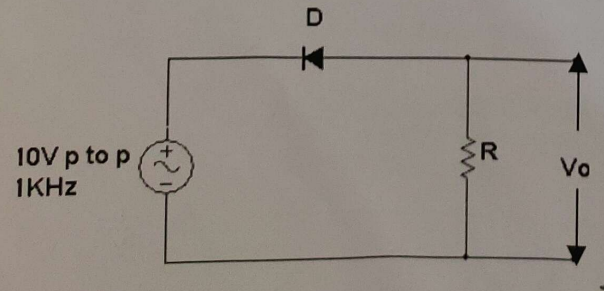
Transfer Characteristics

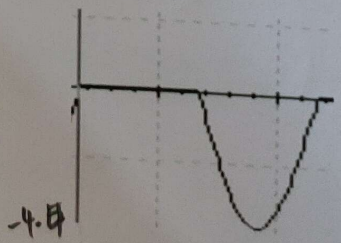


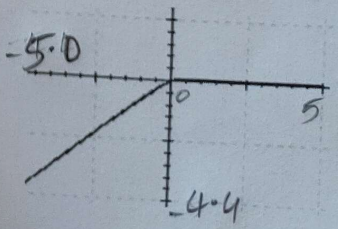




4.4A







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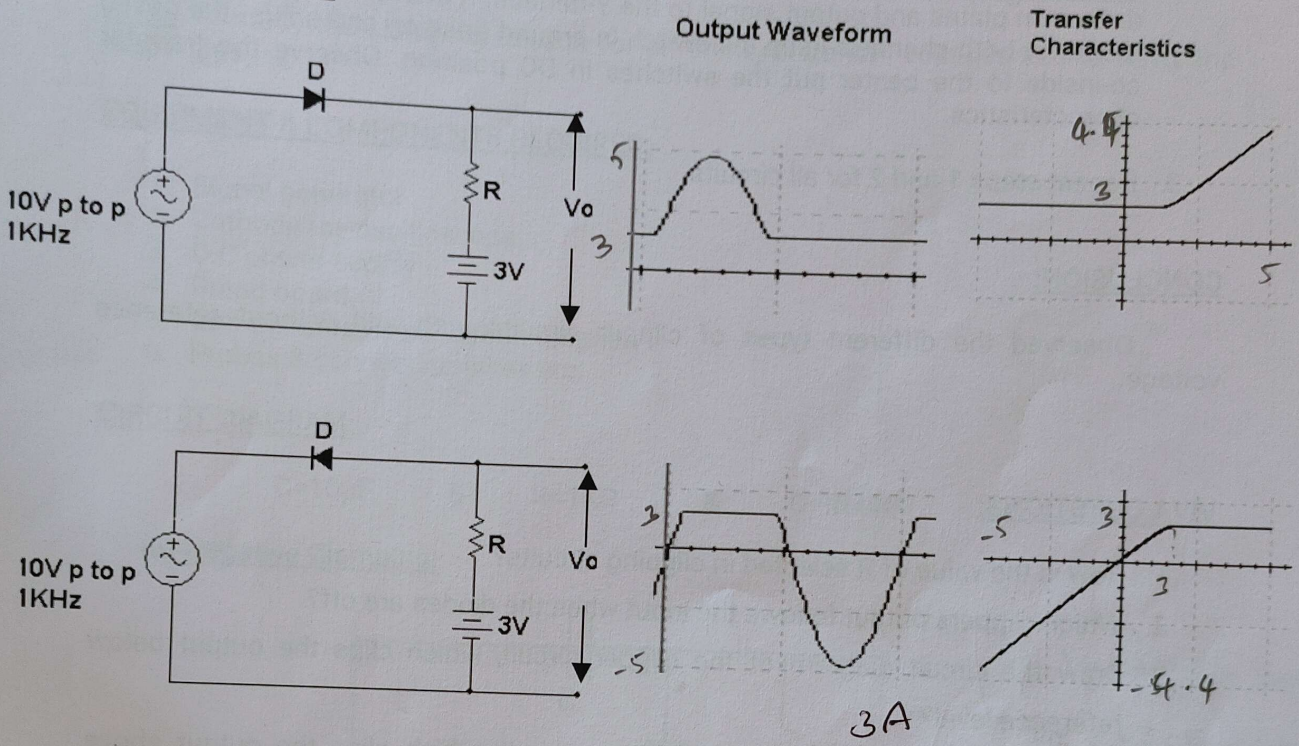
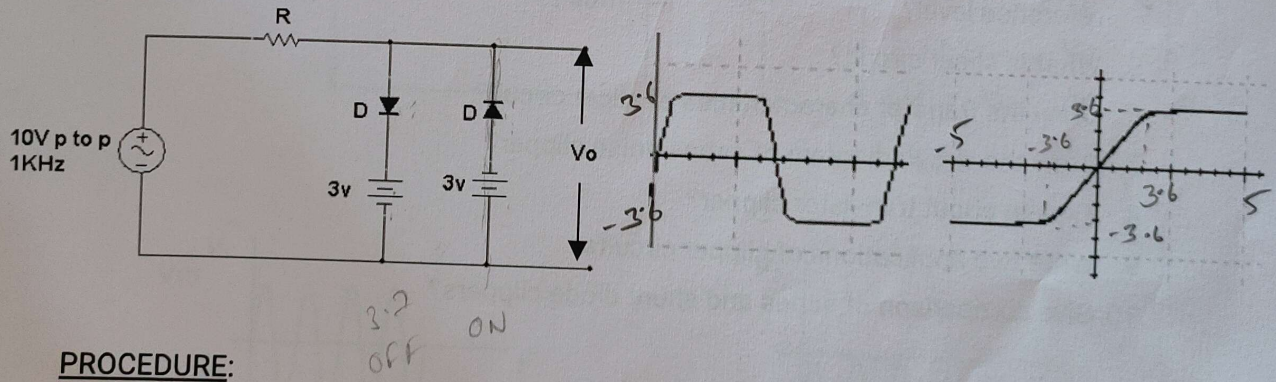
(d) Series Biased



(e) Slicer



PROCEDURE:

Select $R = \sqrt{R_f \times R_r}$ where $R_f = 23.8\ \Omega$ and $R_r = 13.83\ M\Omega$

for diode IN4007 $R = \sqrt{23.8 \times 13.83}\ K\Omega = 18.13\ K\Omega \cong 18\ K\Omega$.

1. To observe output waveform : Connect the circuit as shown in circuit diagram. Apply a 1KHz sine wave input of amplitude 10 V p-p and using CRO observe the output waveform.

Experiment No 13

Types of Clampers at Different Reference Voltages

AIM : To study the clamping circuits for different reference voltages and to verify the responses.

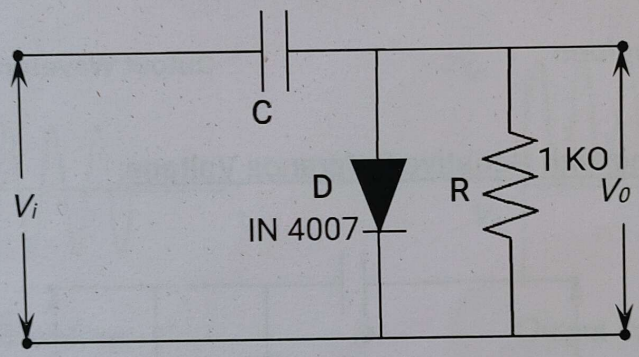
EQUIPMENT & COMPONENTS REQUIRED:

1. Signal generator
2. Cathode ray oscilloscope
3. D.C power supply
4. Bread board.
5. Components as per circuit diagram
6. Probes & connecting wires etc.

CIRCUIT DIAGRAM:

C=10μF & R=1KΩ & D=IN4007

(a) Negative Clamping:



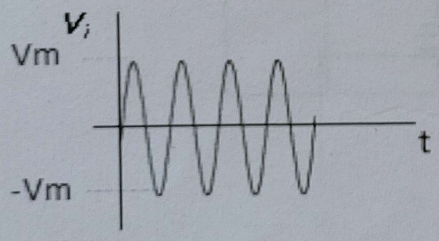
$v_i - V_m + 0.6 - V_o = 0$

$V_o = v_i - V_m + 0.6$

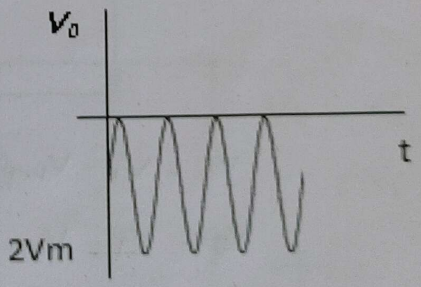
$v_i = 0$, $V_o = -4.4$

$v_i = V_m$, $V_o = 0.6$

$v_i = -V_m$, $V_o = -9.4$

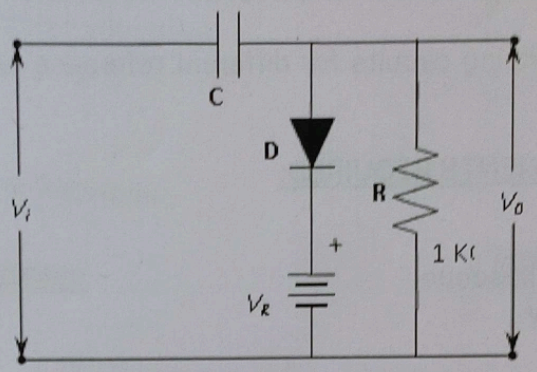


Input Waveform



Output Waveform

(b) Negative Clamping with Positive Reference Voltage:



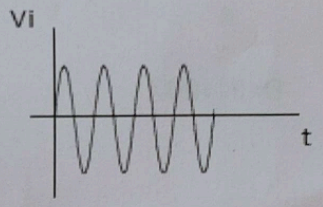
$V_o = V_i - V_m + 0.6 + 3$

$V_o = V_i - V_m + 3.6$

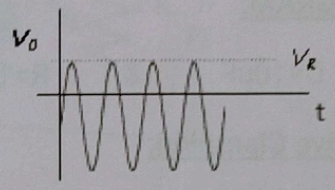
$V_i = 0$, $V_o = -1.4$

$V_i = V_m$, $V_o = 3.6$

$V_i = -V_m$, $V_o = -6.4$

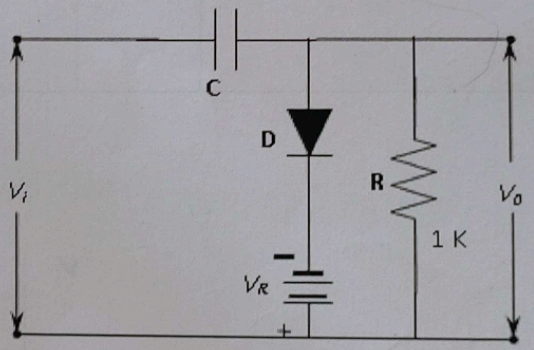


Input Waveform



Output Waveform

(c) Negative Clamping with Negative Reference Voltage:



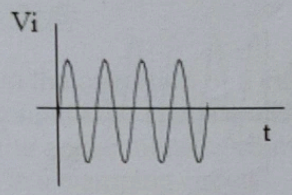
$V_o = V_i - V_m + 0.6 - 3$

$V_o = V_i - V_m - 2.4$

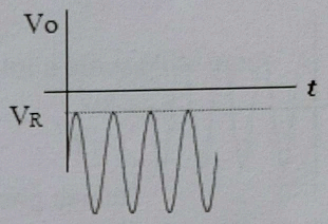
$V_i = 0$, $V_o = -7.4$

$V_i = V_m$, $V_o = -2.4$

$V_i = -V_m$, $V_o = -12.4$.

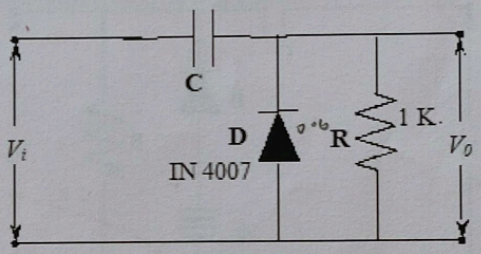


Input Waveform



Output Waveform

(d) Positive Clamping:



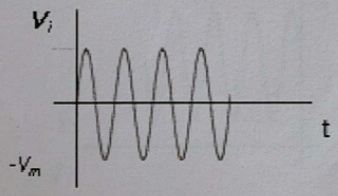
$-0.6 + V_i + V_m - V_o = 0$

$V_o = V_i + V_m - 0.6$

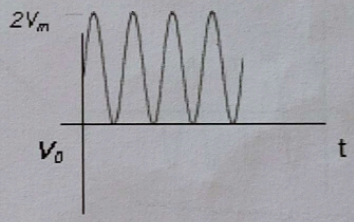
$V_i = 0 \quad V_o = V_m - 0.6 = 4.4$

$V_i = V_m \quad V_o = 2V_m - 0.6 = 9.4$

$V_i = -V_m \quad V_o = -0.6$

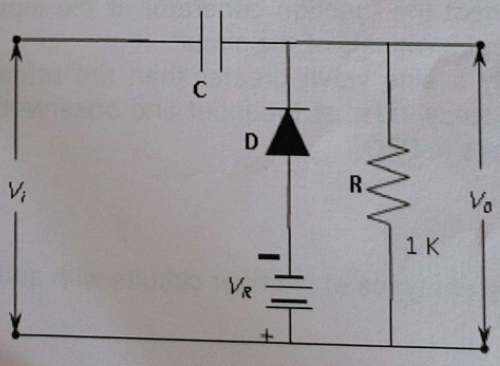


Input Waveform



Output Waveform

(e) Positive Clamping with Negative Reference Voltage:



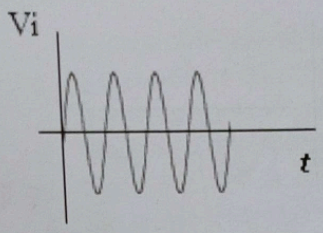
$V_o = V_i + V_m - 0.6 - 3$

$= V_i + V_m - 3.6$

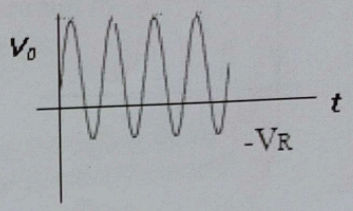
$V_i = 0, \quad V_o = 5 - 3.6 = 1.4$

$V_i = V_m, \quad V_o = 10 - 3.6 = 6.4$

$V_i = -V_m, \quad V_o = -3.6$

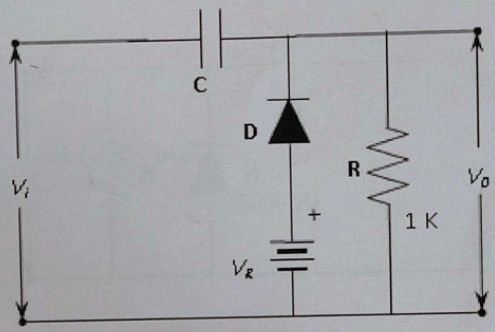


Input Waveform



Output Waveform

(f) Positive Clamping with Positive Reference Voltage:



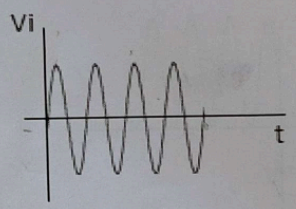
$V_0 = V_i + V_m - 0.6 + 3$

$V_0 = V_i + V_m + 2.4$

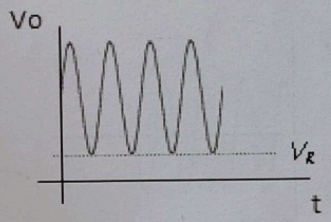
$V_i = 0$, $V_0 = 7.4$

$V_i = V_m$, $V_0 = 12.4$

$V_i = -V_m$, $V_0 = 2.4$



Input Waveform



Output Waveform

PROCEDURE:

1. Connect the circuit as shown in figures.
2. Connect the function generator at the input terminals and CRO at the output terminals of the circuit.
3. Apply a sine wave greater than the reference voltage, and signal of frequency 1kHz at the input and observe the output waveforms of the circuits in CRO.

CONCLUSION:

Observed different types of clamper circuits with and without reference voltage.

Experiment No 14

Output waveform of Clampers for Square wave input

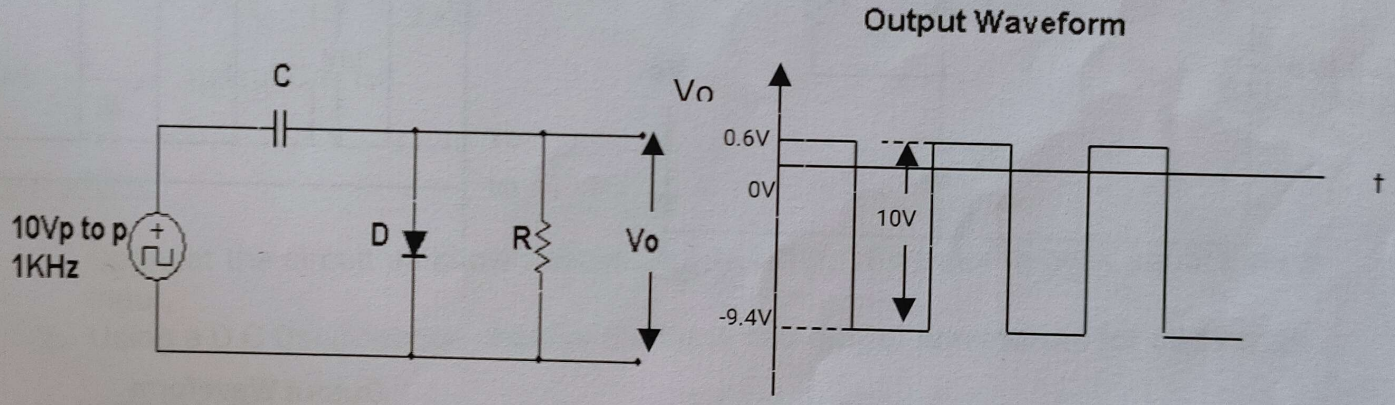
AIM: To study the biased and unbiased clamper circuits.

EQUIPMENT & COMPONENTS REQUIRED:

1. Signal generator
2. Cathode ray oscilloscope
3. D.C power supply
4. Bread board.
5. Components as per circuit diagram
6. Probes & connecting wires etc.

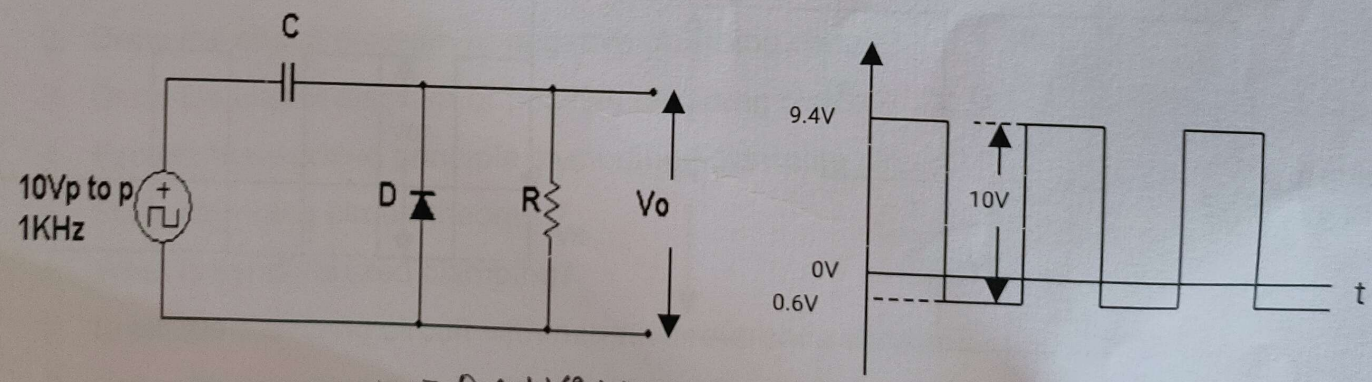
CIRCUIT DIAGRAM:

a) Unbiased Clamper: R = 18kΩ; C = 1μF; D = 1N4007.



$V_i' - V_m + 0.6 - V_o$

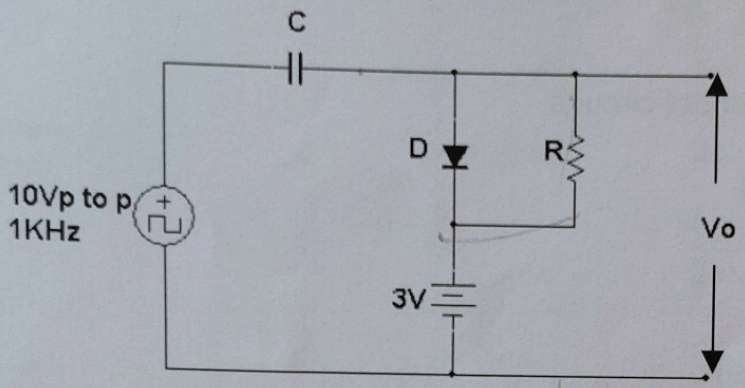
$V_o = V_i' - V_m + 0.6$



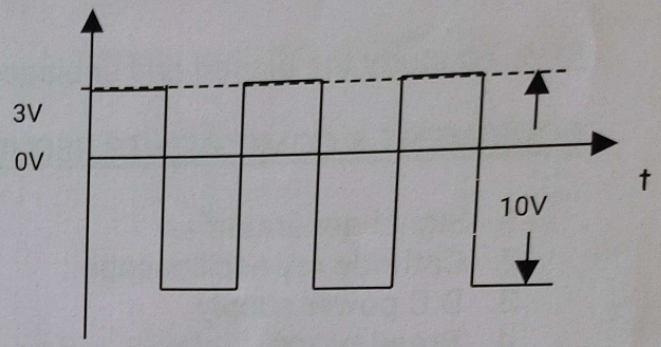
$-0.6 + V_i' + V_m - V_o = 0$

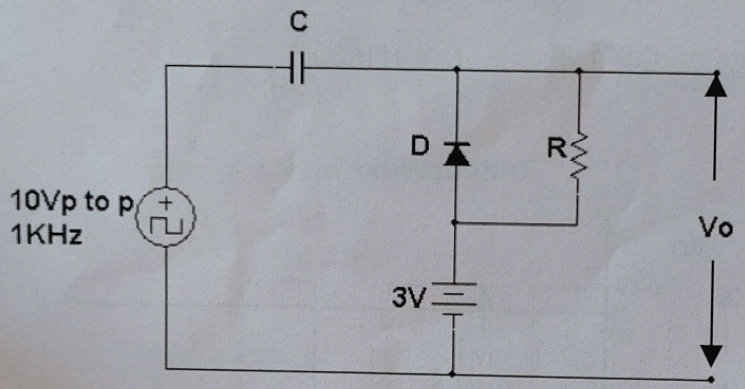
$V_o = V_i' + V_m - 0.6.$

b) Biased Clamper:

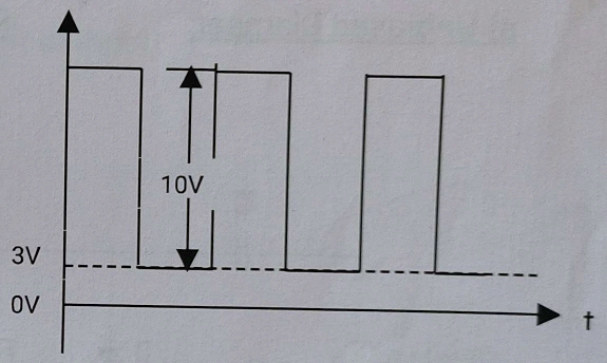


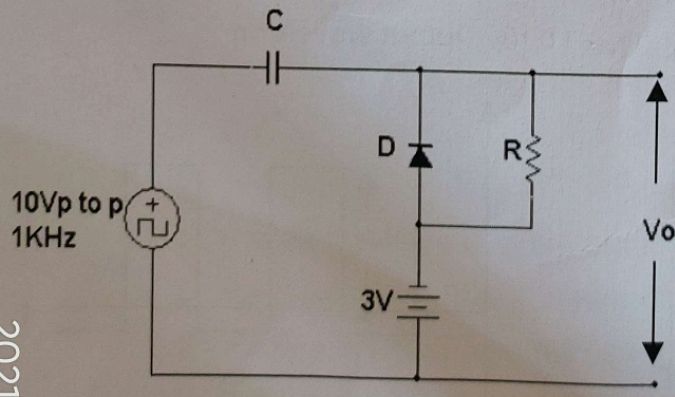
Output Waveform



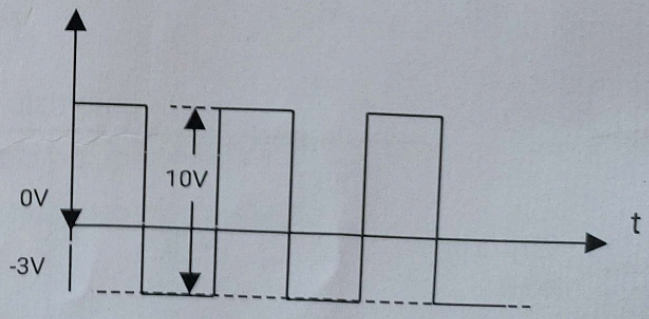


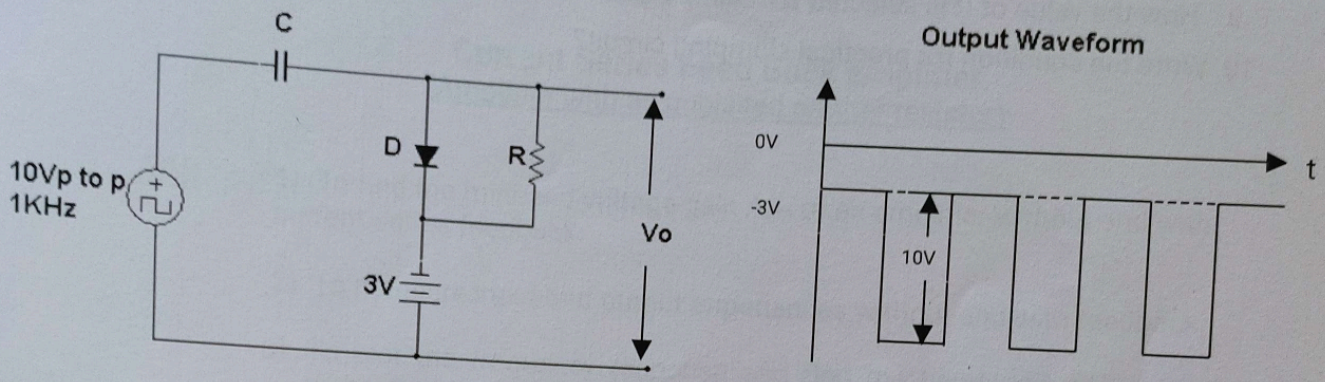
Output Waveform





Output Waveform





Design: Select $R = \sqrt{R_f R_r}$ where $R_f = 23.8\Omega$ and $R_r = 13.83M\Omega$ for diode D = 1N4003, $R = \sqrt{23.8 \times 13.83 \times 10^6} = 18.15k\Omega \cong 18k\Omega$.

Select 'C' the value of capacitor such that $RC >> 10T_1$ where T_1 is time during which diode is reverse biased.

$R=18k\Omega$, $T_1 = \frac{1}{1\times10^3} \times \frac{1}{2}$ sec ($T_1 = \frac{T}{2}$ where T=1/freq of input)

From this $18\times10^3 \times C >> 10 \times \frac{1}{2\times10^3}$

$C >> \frac{10}{2\times18}\mu F$ select C = 1μf.

Procedure:

1. Connect the circuit as shown above. Apply 1KHz, 10V peak-to-peak square wave input.
2. Using a D.C Oscilloscope observe the input and output waveforms for all circuits.

VIVA QUESTIONS:

1. What is a clamping circuit?
2. Draw the circuit diagram of negative clamping circuit?
3. Draw the circuit diagram of positive clamping circuit?
4. Explain the working principle of modified clamping circuit?
5. State clamping circuit theorem?
6. What is synchronized clamping?
7. Draw the clamping circuit with negative reference voltage?
8. Draw the clamping circuit with positive reference voltage?