EXPERIMENT 5
Clipping & Clamping Circuits

Objective
To calculate, compare, draw, and measure the output voltages of series and parallel clipping circuits.

Tools and Equipments Required
- DMM (Digital Multi Meter)
- DC Power Supply
- Function Generator
- 1 uF x 1
- 2.2 kΩ x 1
- 1 kΩ x 1
- Germanium Diode x 1
- Silicon Diode x 1

PROCEDURE

PART 1. Threshold Voltage
Determine the threshold voltage for the silicon and germanium diodes, $V_T$, using the diode-checking capability of the DMM.

$V_T$ (silicon) = ________________
$V_T$ (germanium) = ________________

PART 2. Parallel Clippers
a) Record the measured value of resistance value of $R$ and construct the circuit of Fig. 3.1. Note that the input voltage is an 8 V$_{p-p}$ square-wave at frequency of 1000 Hz. (Here $E$ = 1.5V DC supply)
b) Using the measured values of $V_T$, $E$, and $R$, calculate the output voltage $V_O$. Show all steps of your calculations. Note that the output voltage will have different values for each input values of $+4$ V and $-4$ V.

$$V_O(\text{calculated}) = \underline{\text{and}}$$


c) Sketch the expected waveform on Graph 3.1 for $V_O$.

\[\text{Graph 3.1 Expected waveform}\]

\[\text{Volt/Div=}\underline{\text{………………..}}\]

\[\text{Time/Div=}\underline{\text{………………..}}\]
d) Sketch the **observed waveform** on Graph 3.2. [from the oscilloscope (while coupling switch is at DC position)]

![Graph 3.2 Observed waveform]

Volt/Div=………………….

Time /Div=………………

**Graph 3.2 Observed waveform**

e) **Reverse the DC source E** and calculate the output voltage $V_O$. Show all steps of your calculations. Note that the output voltage will have different values for each input values of +4 V and -4 V)

$V_O$(calculated)= ______ and ______
f) Sketch the expected waveform on Graph 3.3 for $V_O$.

![Graph 3.3 Expected waveform](image)

Volt/Div=…………………..

Time /Div=………………..

Graph 3.3 Expected waveform

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g) Sketch the **observed waveform** on fig.3.4 [from the oscilloscope (while coupling switch is at DC position)]

![Graph 3.4 Observed waveform](image)

Volt/Div=…………………..

Time /Div=…………………..
Part 3: Clamper Circuits

Construct the network of Fig.4.1. and change the input signal to 8 V\text{p-p} square wave at frequency of 1 kHz

![Clamper Circuit Diagram](image)

**Figure 4.1.**
Sketch the observed waveform on Table 4.1.a from the oscilloscope

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Table 4.1.a Observed waveform

Reverse the Diode and Sketch the observed waveform on Table 4.1.b from the oscilloscope

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Table 4.1.b Observed waveform
PART 4. Clampers – Effect of R

a) Determine the time constant \( \tau = RC \) for the network at Figure 4.1. for measured values of R and C, then change the input signal to 8 V\(_{pp}\) sinusoidal-wave at frequency of 1000 Hz

\[
\begin{align*}
R \text{ (measured)} &= \underline{\quad} \\
C \text{ (measured)} &= \underline{\quad} \\
\tau \text{ (calculated)} &= \underline{\quad}
\end{align*}
\]

b) Calculate the period of the input signal and determine half of the period as “off” state for the diode. Note that \( T(\text{period}) = 1/f(\text{frequency}) \)

\[
\begin{align*}
T \text{ (calculated)} &= \underline{\quad} \\
T/2 \text{ (calculated)} &= \underline{\quad}
\end{align*}
\]

c) The discharge (or charge) period of an RC circuit is 5\( \tau \). And for good clamping action it is important that 5\( \tau \) must be much larger than \( T/2 \) of applied signal. Compare calculated values of 5\( \tau \) and \( T/2 \).

d) Change R to 1 k\( \Omega \). What would you expect for the output waveform \( V_O \) depend on \( T/2 \) and new 5\( \tau \) values?

e) Record the observed output waveform to Table 4.3.a.
f) Is there any distortion? Are you surprised by the positive and negative peaks? Why?