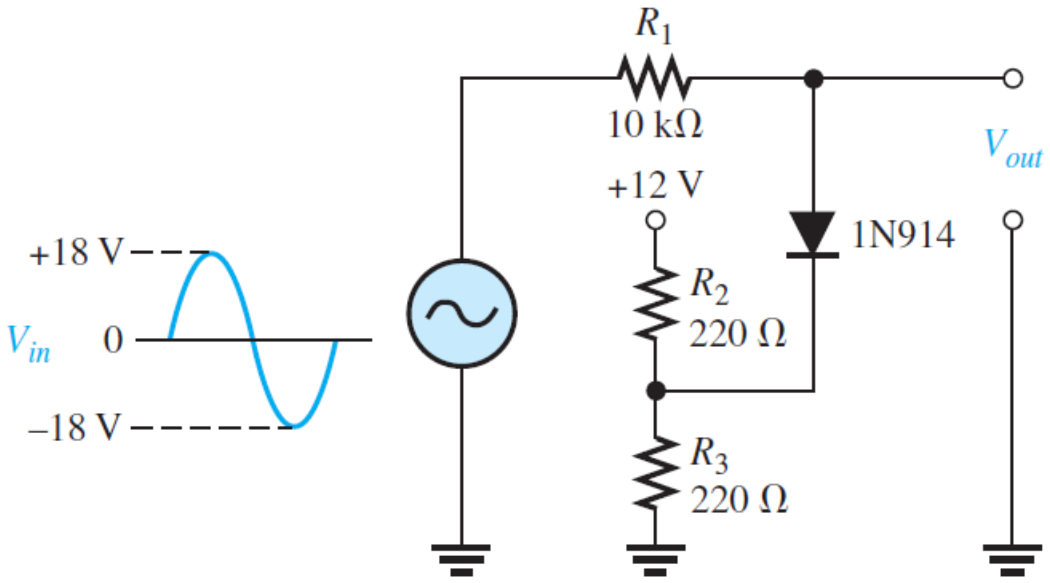
ASSIGNMENT-7

U19CS012

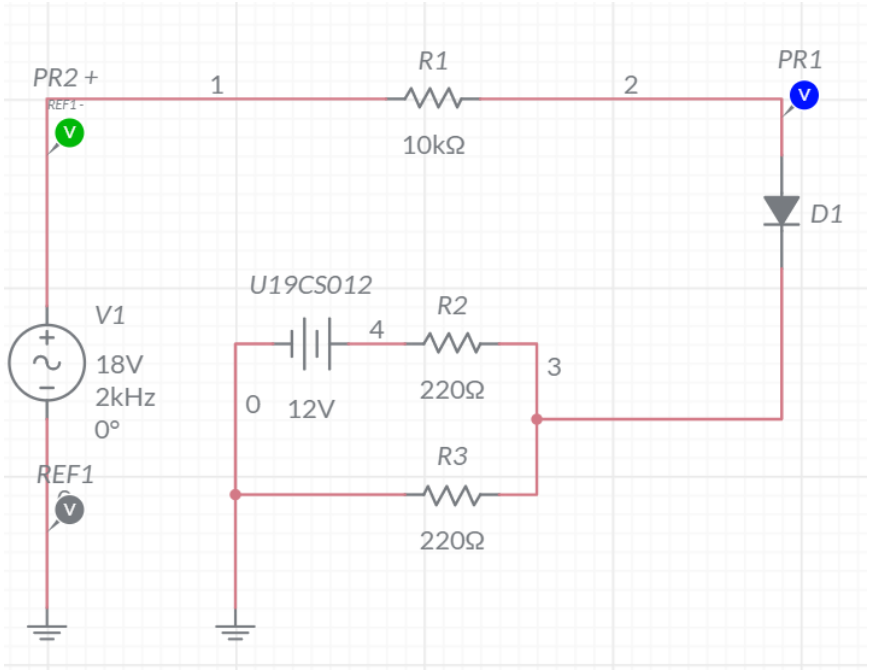
1. Determine and plot the output voltage waveform for the given circuits. Also verify the same using Multisim.

Circuit a.)

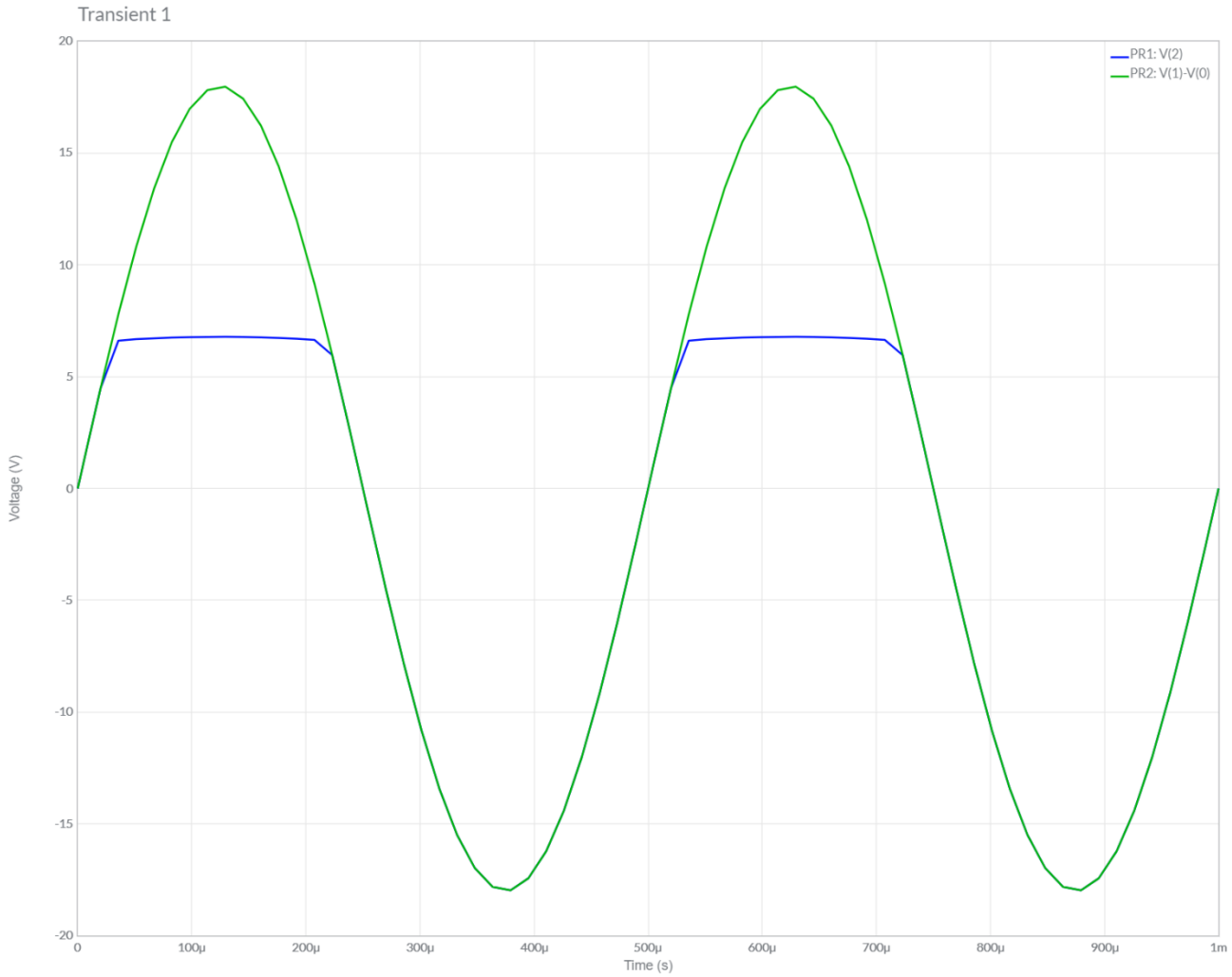


A.) Multisim Calculations:

1.) <u>Circuit Image</u>:



2.) <u>Grapher Image</u>:



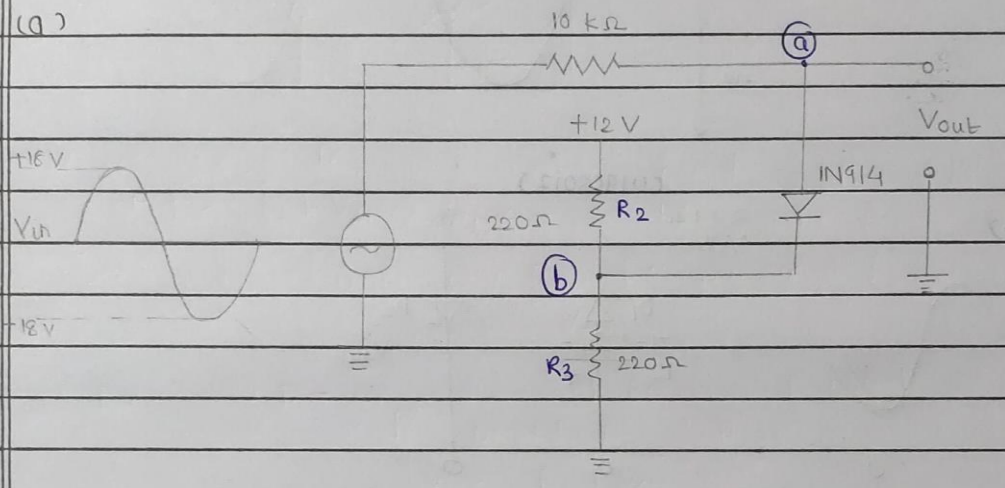
B.) Theoretical Calculations:

Practical - 7 Assignment (1)

(UI9CS012)

Q.1.) Determine and Plot Output Voltage waveform

(a)



→ Current through 12 V battery and passing through R_2 and R_3.

$$I = \frac{12}{R_2 + R_3} = \frac{12}{220+220} = \frac{12}{440}$$

Voltage at b, $V_b = I \times R_3 = \frac{12}{440} \times 220 = 6V$

∴ Voltage at Cathode of Diode = 6V

∴ $V_i(t) < (6 + 0.7)$ V diode will be reverse biased,

∴ Diode $\xrightarrow{act}$ Open circuit

∴ $\boxed{V_o = V_i(t)}$ for $[V_i(t) < (6.7)\ V]$ — (1)

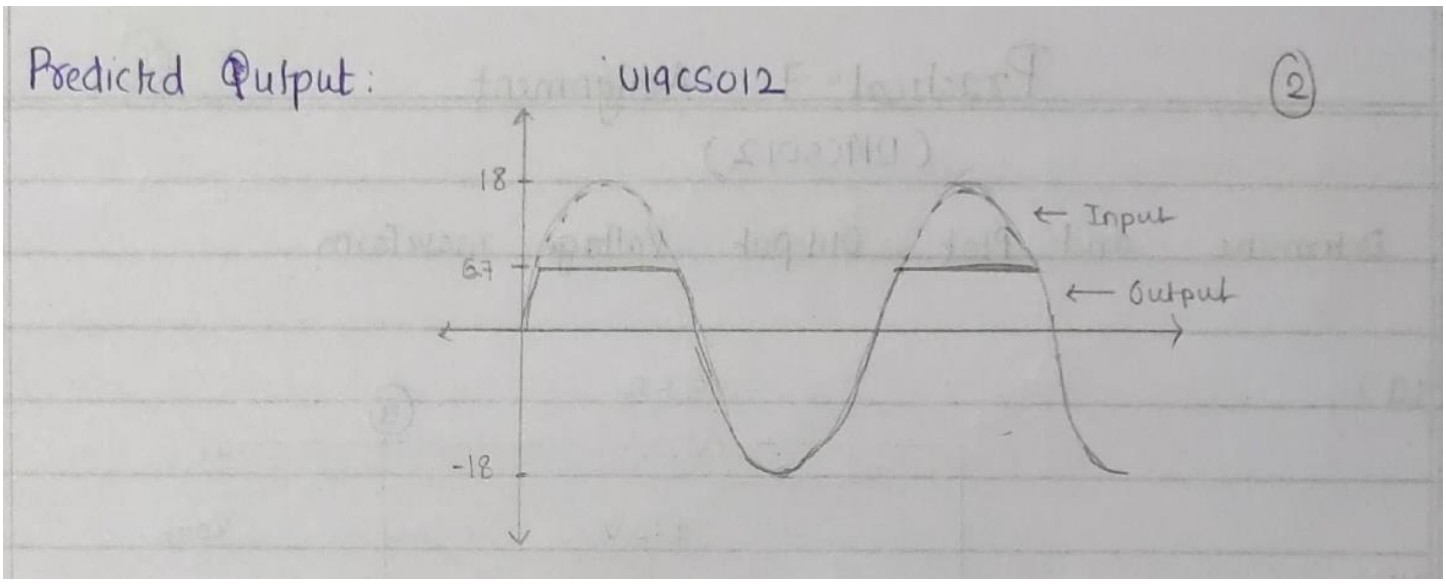
→ For $V_i(t) > 6.7$ V, diode will be forward biased and will act as Short circuit for voltage drop of 0.7 V

∴ $V_a = V_b + 0.7 = (6 + 0.7)$ V

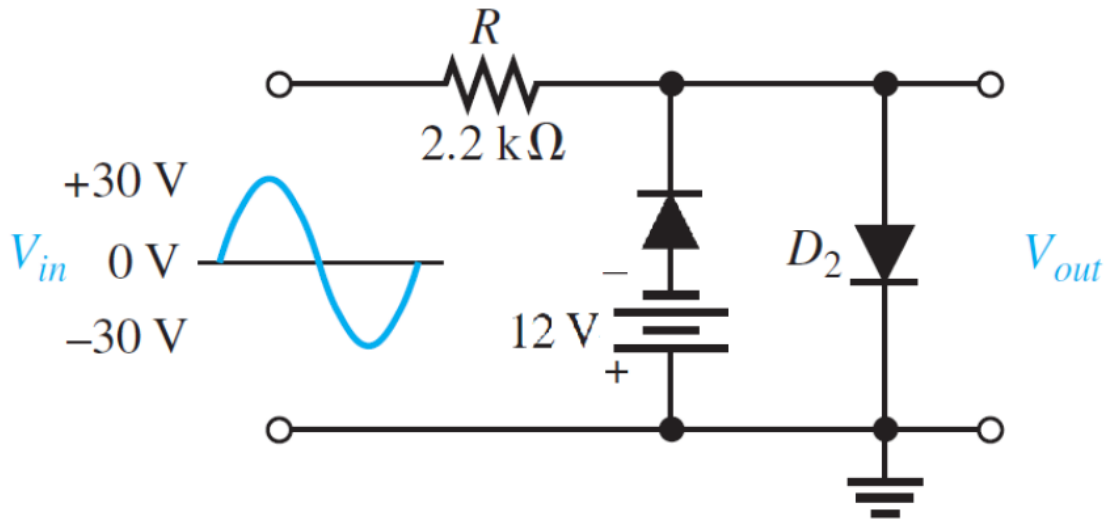
∴ $V_a = 6.7$ V

∴ $\boxed{V_o = 6.7\ V}$ for $[V_i > 6.7\ V]$ — (2)

VISION

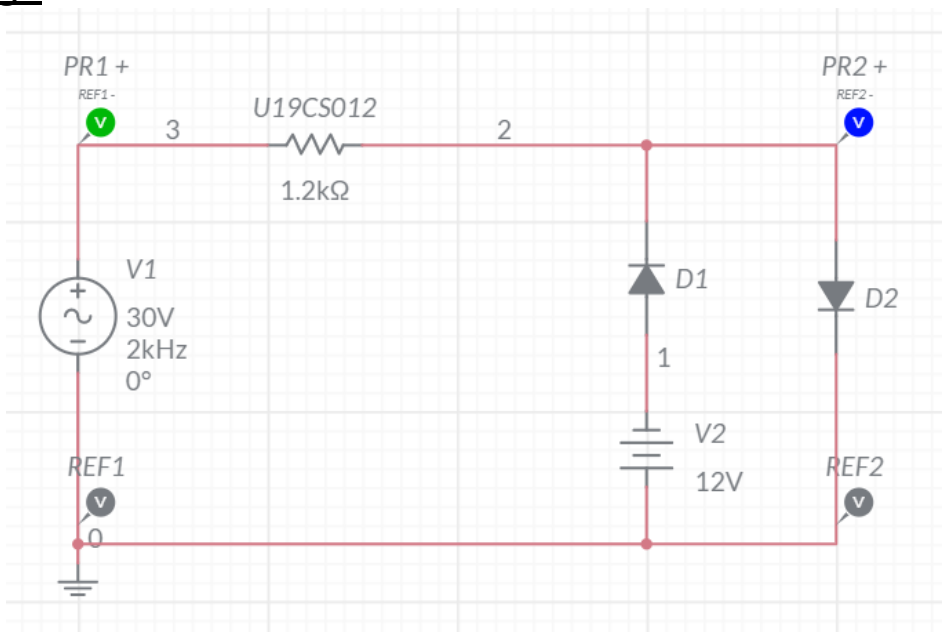

Predicted Output:
U19CS012
(2)
18
6.7
-18
← Input
← Output

Circuit b.)

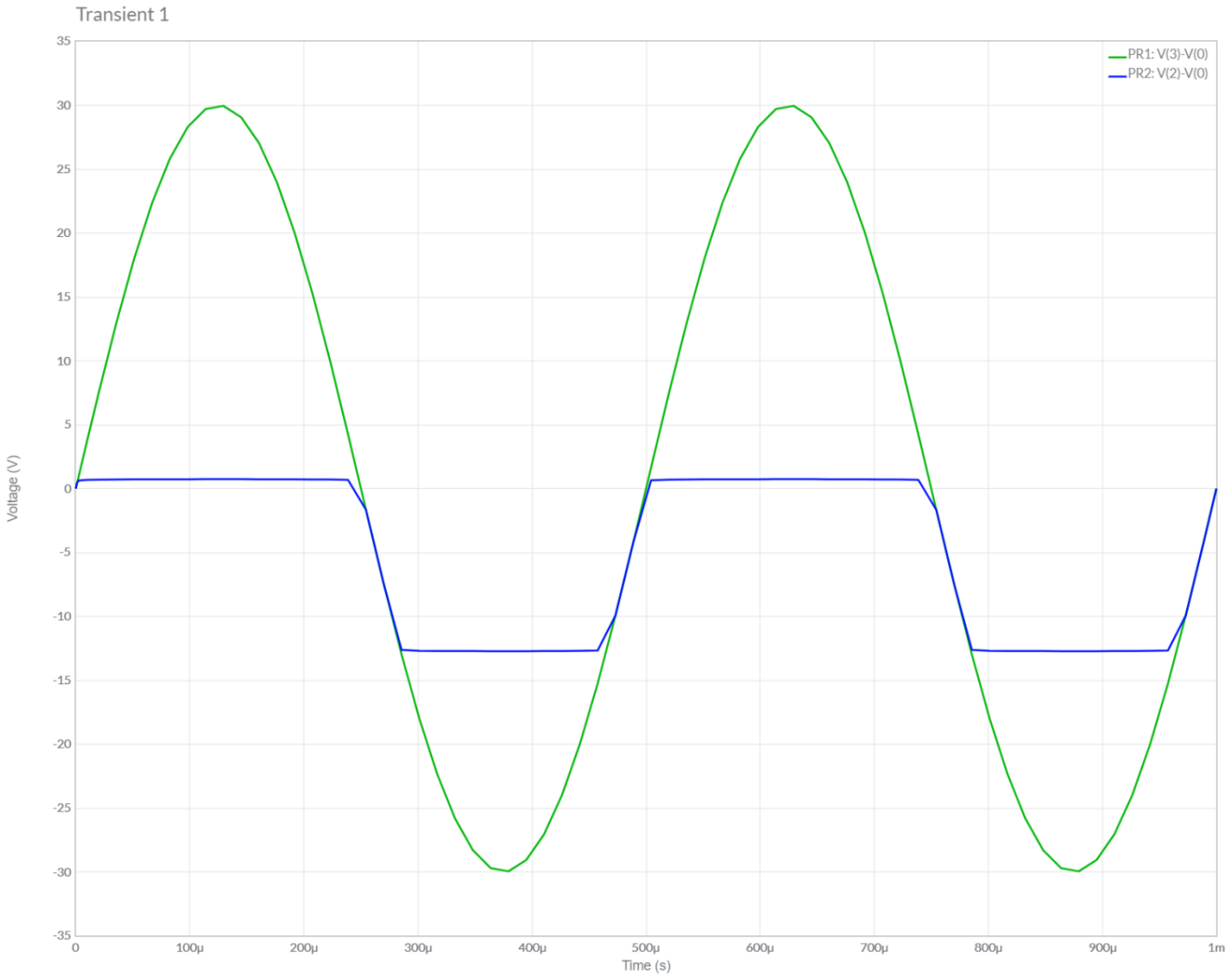

R
2.2 kΩ
+30 V
V_{in} 0 V
–30 V
12 V
D_2
V_{out}

A.) Multisim Calculations:

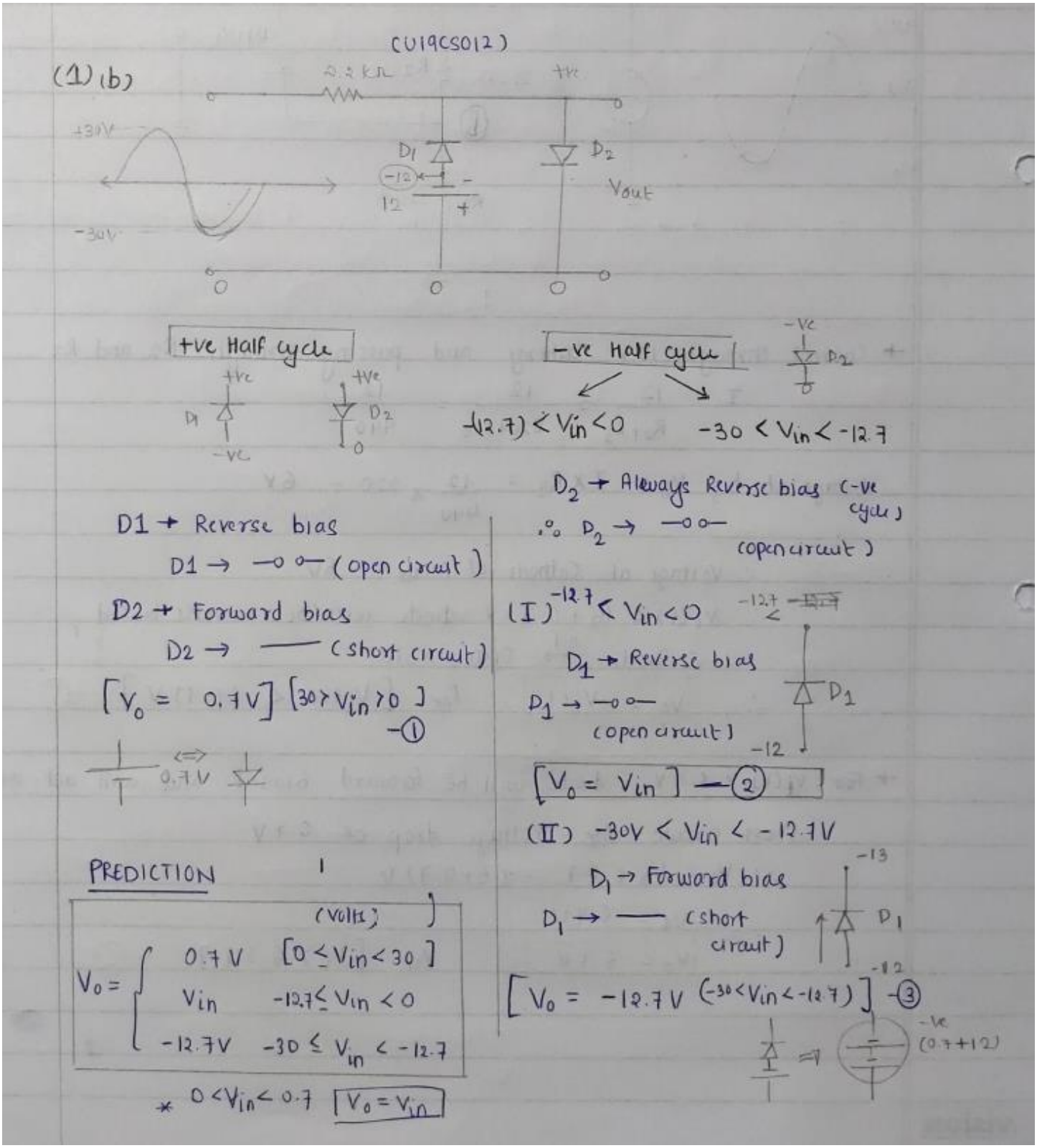
1.) *Circuit Image*:

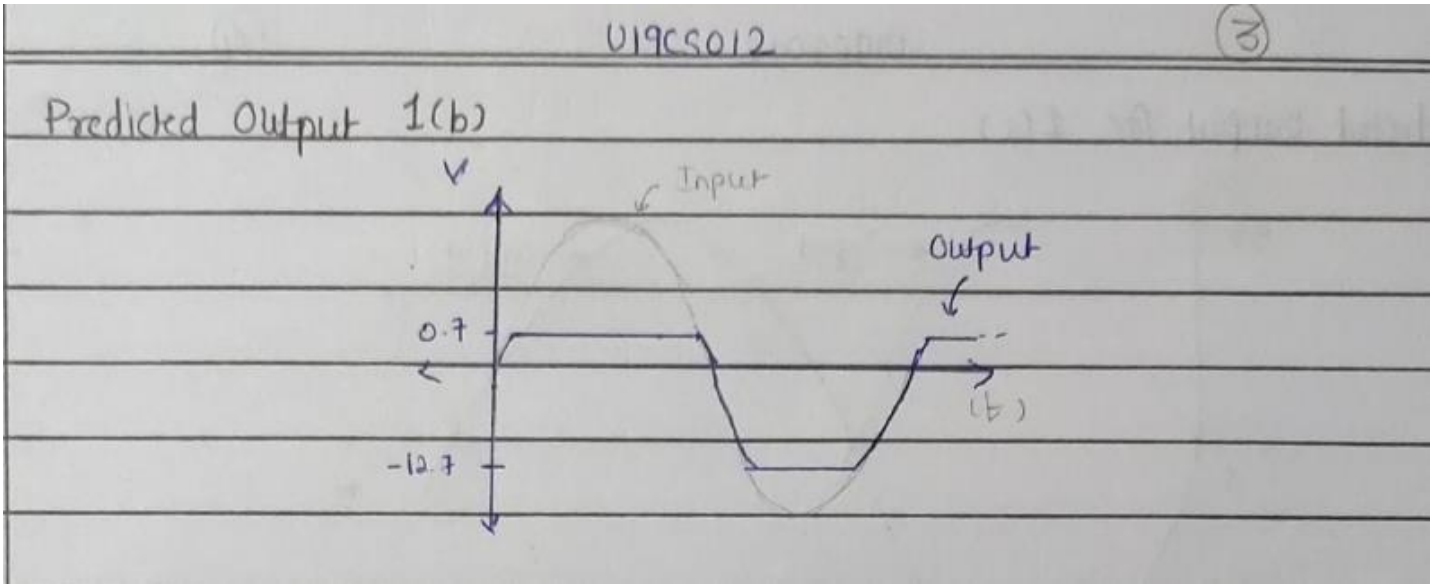


2.) *Grapher Image*:

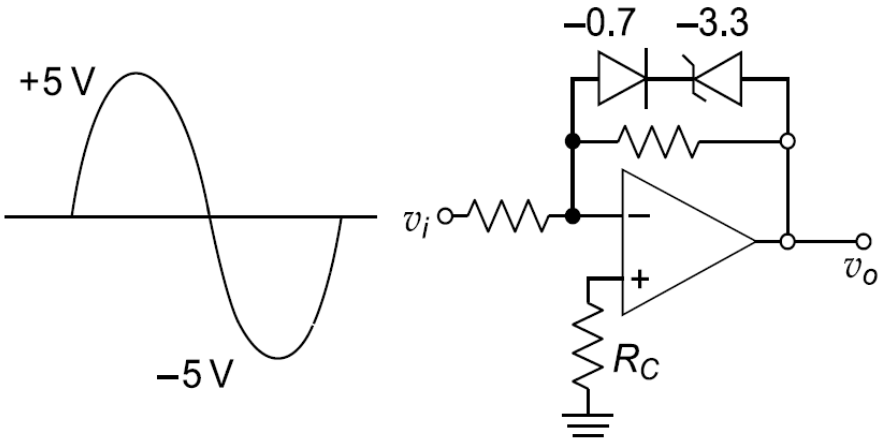


B.) Theoretical Calculations:



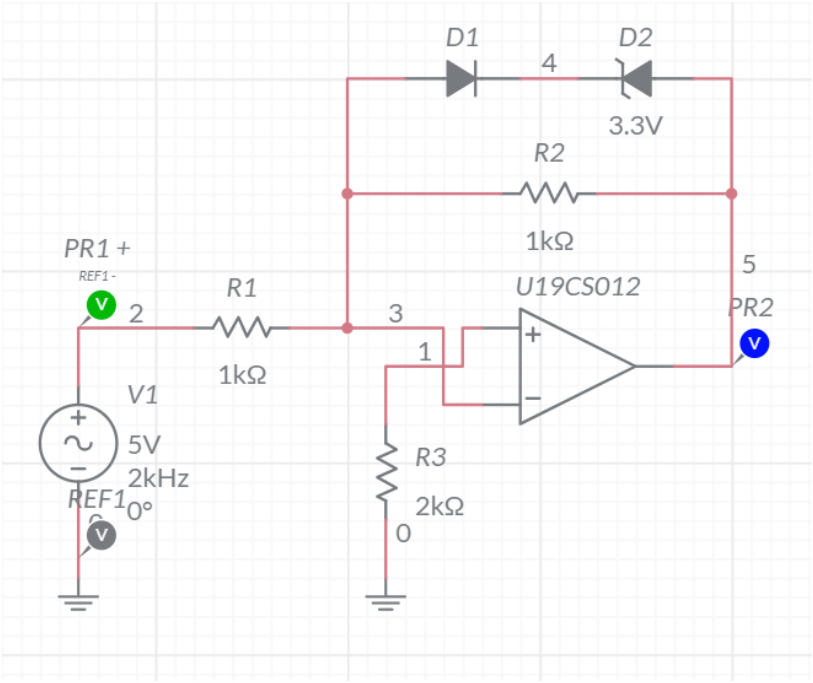

U19CS012
3
Predicted Output 1(b)
V
Input
Output
0.7
-12.7
(t)

Circuit c.)

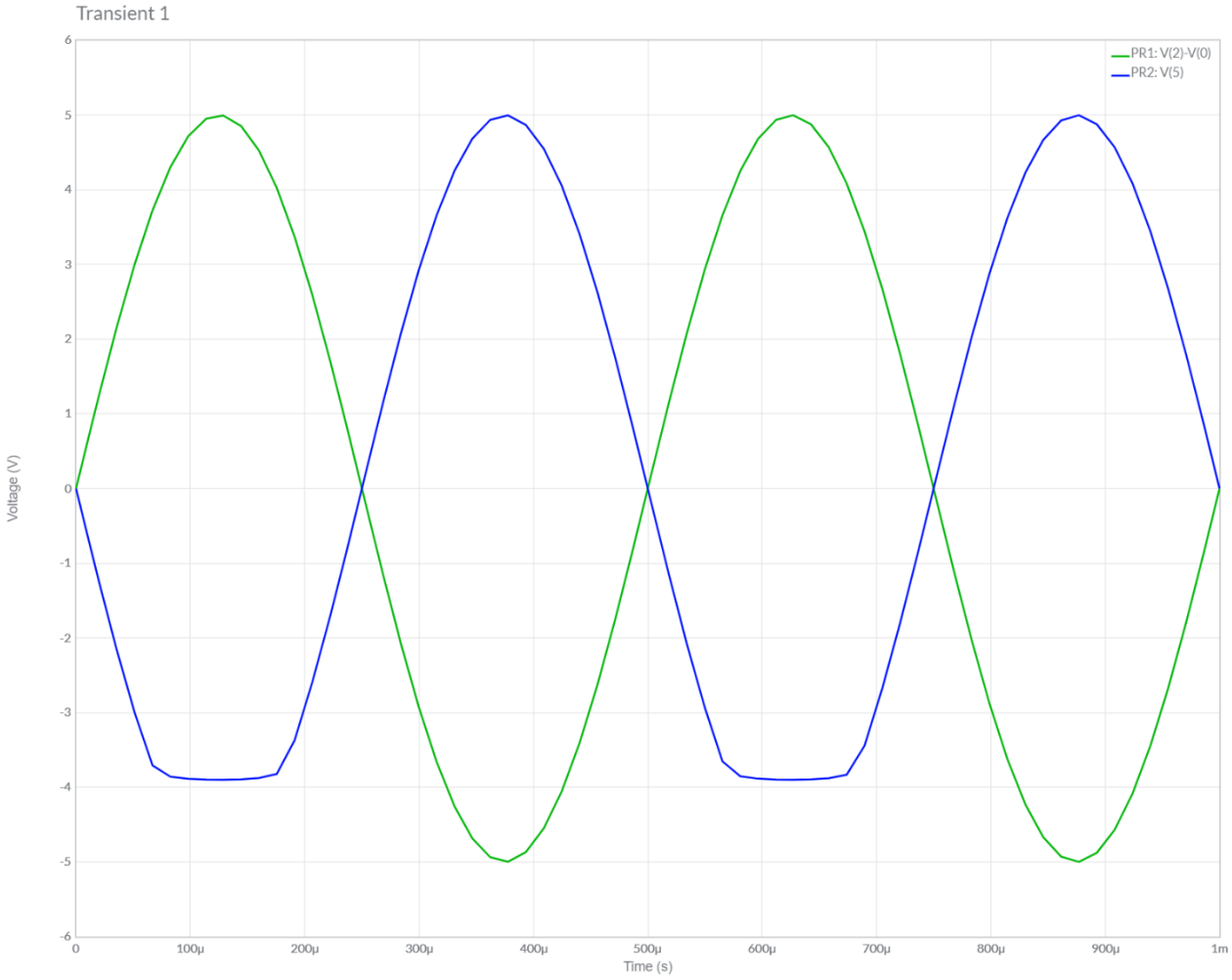

+5 V
−5 V
−0.7
−3.3
v_i
v_o
R_C

A.) Multisim Calculations:

1.) <u>Circuit Image</u>:

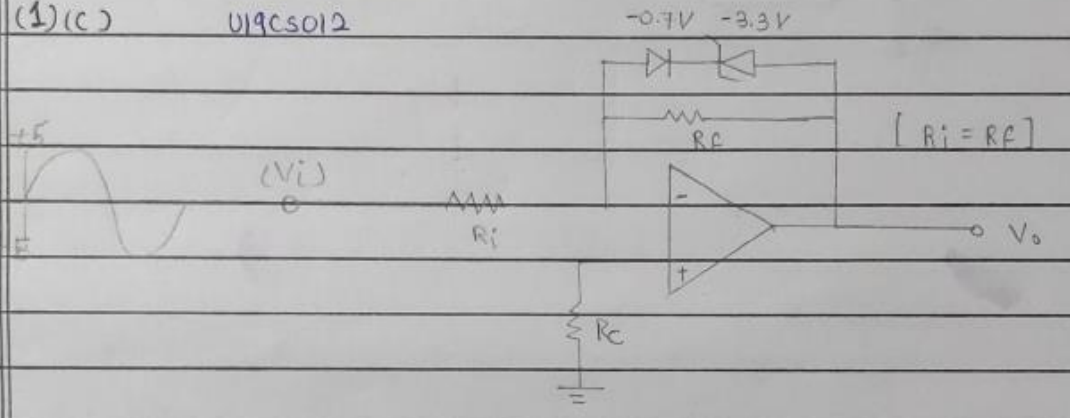


2.) <u>Grapher Image</u>:



B.) Theoretical Calculations:

(1)(c) U19CS012



For $4V > V_i > 0V$, zener diode will be reverse biased and no current will flow through diode [less than breakdown voltage]

$$\therefore \quad V_o = -\frac{R_f}{R_i} V_i = -V_i \qquad (\because R_f = R_i)$$

$[4V > V_i > 0V]$ —①

For $V_i > 4V$, zener diode will reach breakdown & pn diode will be forward biased. So voltage drop will be $-0.7 - 3.3 = -4V$

So, $\boxed{V_o = -4V \qquad [V_i > 4V]}$ —②

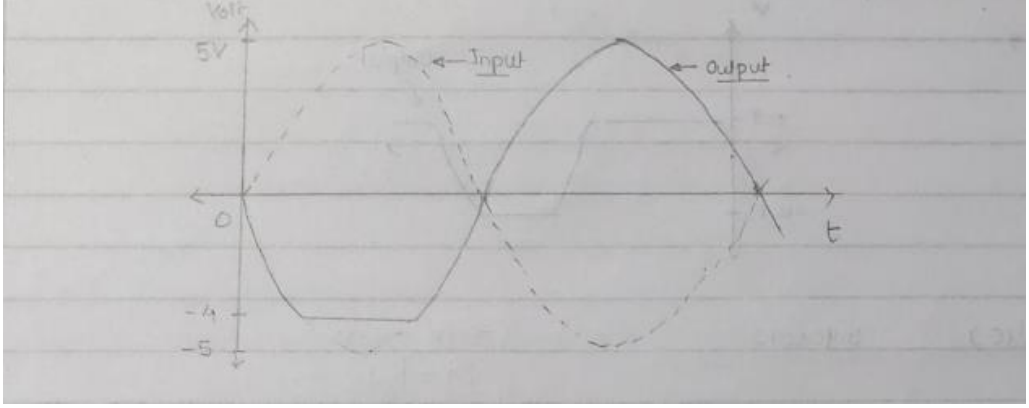
For $V_i < 0V$ pn diode will be reverse biased, so —o o— open circuit

No current will flow through diode.

$$\boxed{V_o = -V_i \qquad V_i < 0}$$

U19CS012 ④

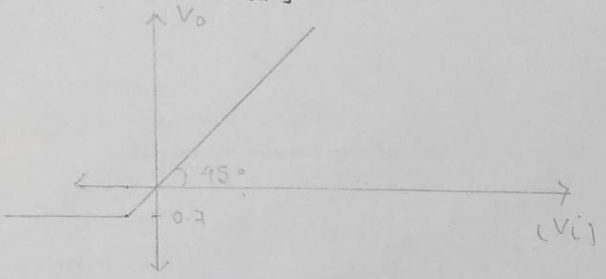
Predicted output for 1(c)



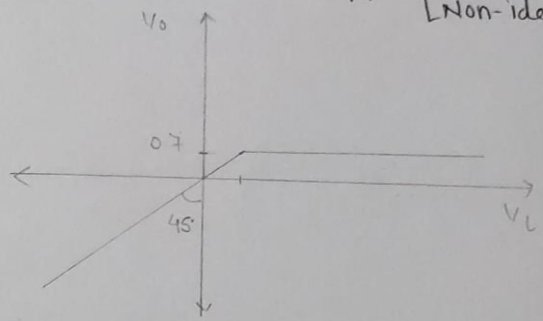
2. Draw the transfer characteristics for all the clipper configurations which are part of your today's practical (Practical – 7).

Q2.) U19CS012

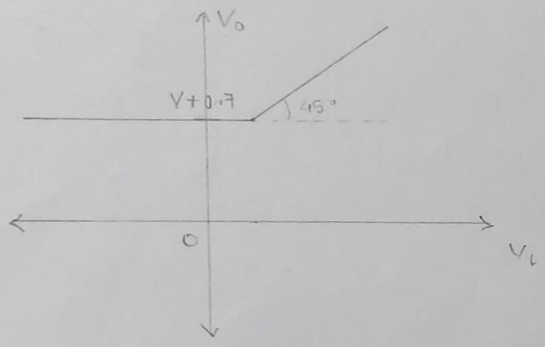
(1) Shunt Negative Clipper [Non- Ideal]



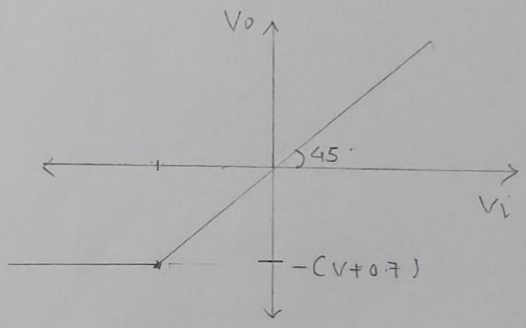
(2) Shunt Positive Clipper [Non-ideal]



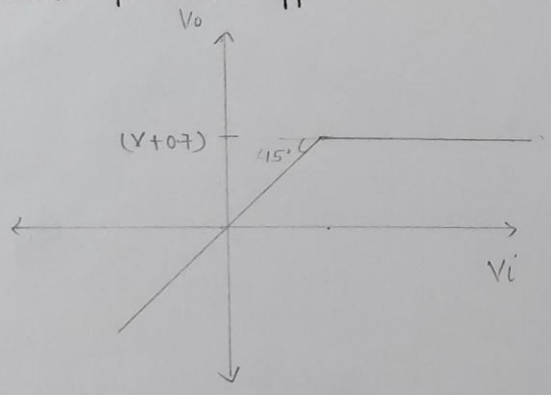
(3) Shunt Negative Clipper with Bias - I



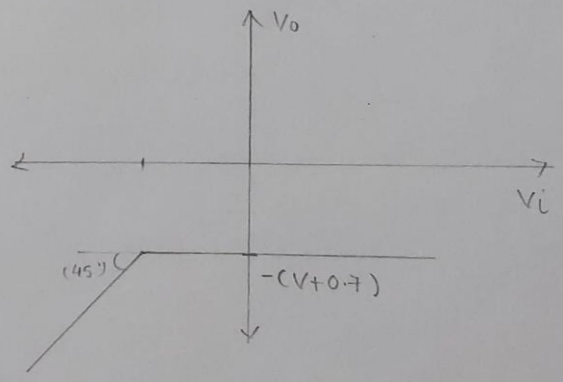
(4) Shunt Negative Clipper with Bias II



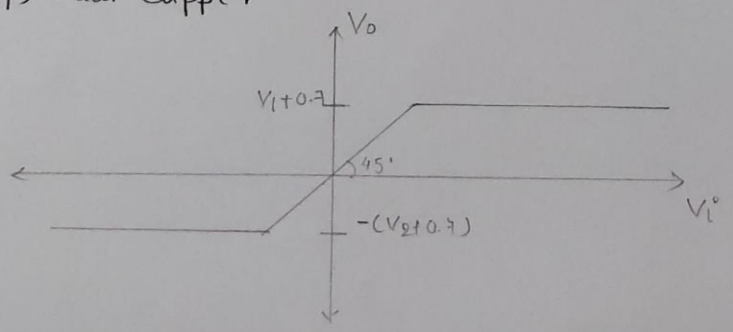
(5) Shunt positive Clipper with Bias - I



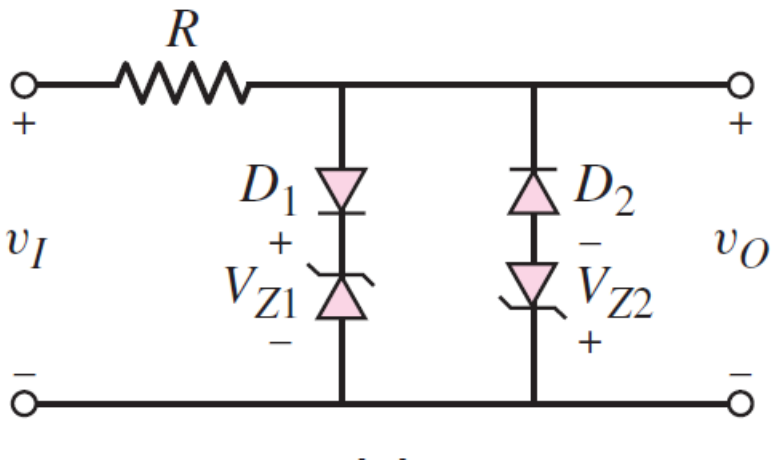
(6) Shunt positive Clipper with bias & II



(7) Dual Clipper

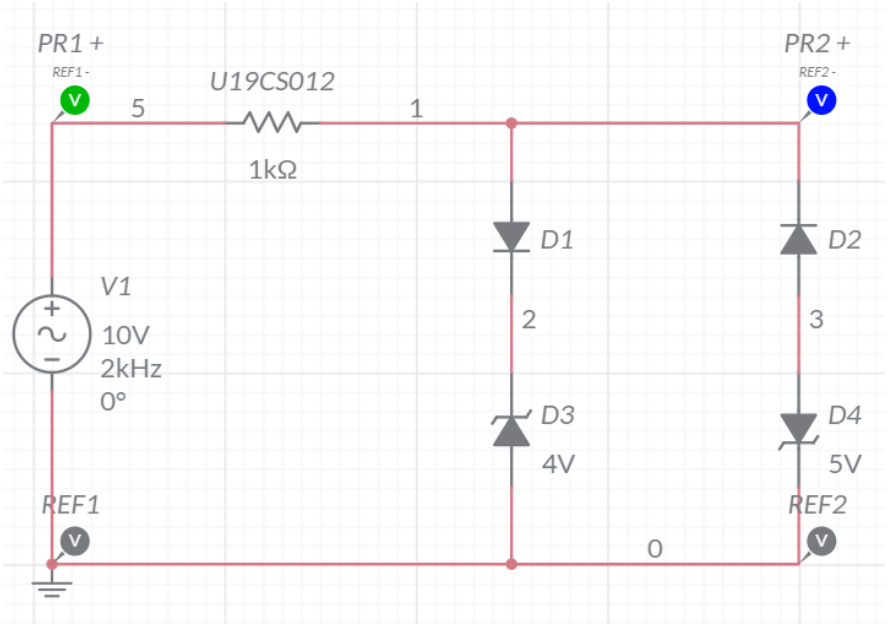


3. Assuming Symmetrical Sine wave input with peak value greater than the Zener reference voltage, predict the output and plot the Transfer Characteristics for the following Clipper Circuits:

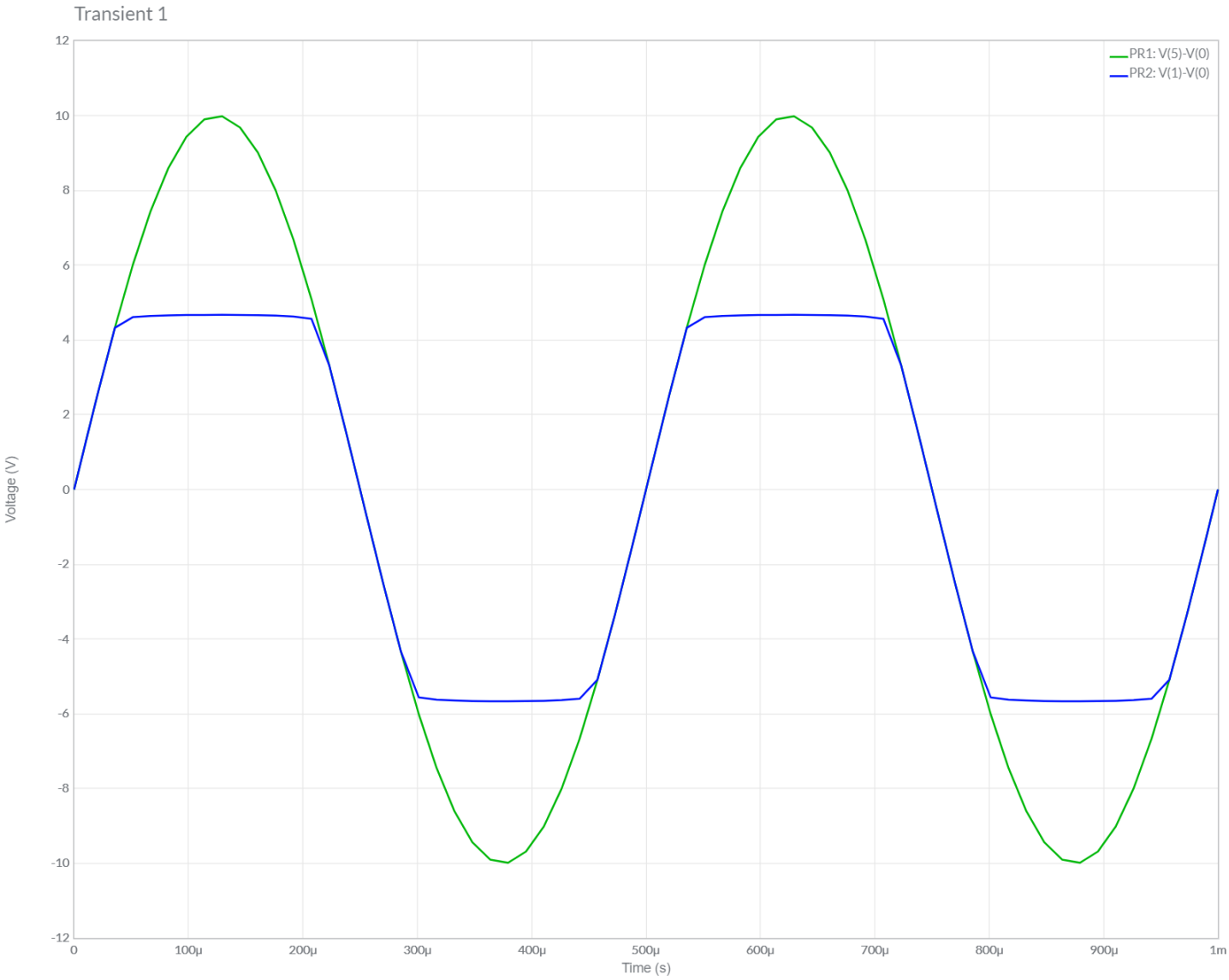


A.) Multisim Calculations:

1.) <u>Circuit Image</u>:



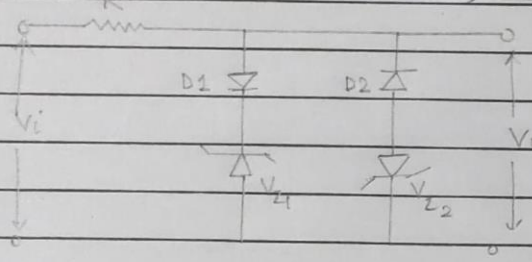
2.) *Grapher Image*:



B.) Theoretical Calculations:

(U19CS012) (6)

Q.3.)



i) For $V_i > 0$, D_2 will be reverse biased, so it will be open circuit

→ For $D_1 + V_{z1} > V_i > 0$; D1 will be Reverse Biased and no current will flow [∵ open circuit]

$$\therefore V_o = V_i$$

For $V_i > D_1 + V_{z1}$; D1 will be forward biased and zener diode will reach breakdown voltage

$$\therefore \boxed{V_o = D_1 + V_{z1}}$$

ii) For $V_i < 0$; D1 will be reverse biased

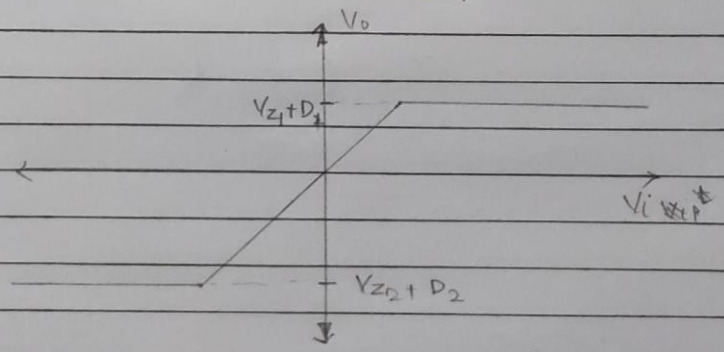
So, it will be open circuit

For $D_2 + V_{z2} < V_i < 0$; D_2 will be reverse biased so open circuit and no current will flow.

$$[\therefore V_o = V_i]$$

For $V_i < D_2 + V_{z2}$; D_2 will be forward biased and zener diode will reach Breakdown, so,

$$\therefore \boxed{V_o = V_{z1} + V_{D_2}}$$



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