MECE 233
LAB 9
DIODE CIRCUITS

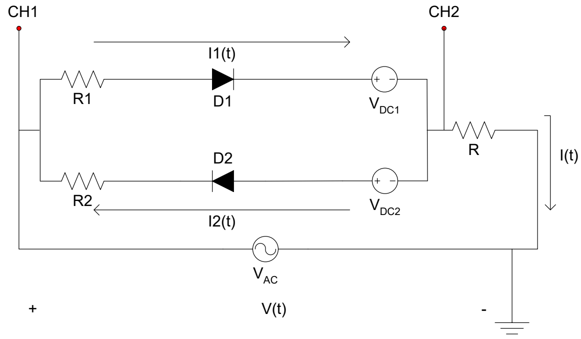

Figure 1: Diode circuit 1

- Theoretical analisis for the circuit in Figure 1, (assuming that the diodes are not ideal and their threshold values are V_T and $V_{DC1}+V_T>V_{DC2}-V_T$).

If $V \geq V_{DC1}+V_T$ then $I_1 = \dfrac{V-V_{DC1}-V_T}{R_1+R}$, $I_2=0$ and $I=I_1-I_2=\dfrac{V-V_{DC1}-V_T}{R_1+R}$ Amper

If $V_{DC2}-V_T \leq V \leq V_{DC1}+V_T$ then $I_1=0$, $I_2=0$ and $I=I_1-I_2=0$ Amper

If $V \leq V_{DC2}-V_T$ then $I_1=0$, $I_2=\dfrac{V_{DC2}-V_T-V}{R_2+R}$ and $I=I_1-I_2=\dfrac{V-V_{DC2}+V_T}{R_2+R}$ Amper

- Theoretical analisis for the circuit in Figure 1, (assuming that the diodes are not ideal and their threshold values are V_T and $V_{DC1}+V_T=V_{DC2}-V_T$).

If $V \geq V_{DC1}+V_T=V_{DC2}-V_T$ then $I_1=\dfrac{V-V_{DC1}-V_T}{R_1+R}$, $I_2=0$ and

$I=I_1-I_2=\dfrac{V-V_{DC1}-V_T}{R_1+R}$ Amper

If $V \leq V_{DC2}-V_T=V_{DC1}+V_T$ then $I_1=0$, $I_2=\dfrac{V_{DC2}-V_T-V}{R_2+R}$ and

$I=I_1-I_2=\dfrac{V-V_{DC2}+V_T}{R_2+R}$ Amper

- Theoretical analisis for the circuit in Figure 1, (assuming that the diodes are not ideal and their threshold values are V_T and $V_{DC1}+V_T<V_{DC2}-V_T$).

If $V \geq V_{DC2}-V_T$ then $I_1=\dfrac{V-V_{DC1}-V_T}{R_1+R}$, $I_2=0$ and $I=I_1-I_2=\dfrac{V-V_{DC2}+V_T}{R_1+R}$ Amper

If $V_{DC1}+V_T \leq V \leq V_{DC2}-V_T$ then $I_1=\dfrac{V-V_{DC1}-V_T}{R_1+R}$, $I_2=\dfrac{V_{DC2}-V_T-V}{R_2+R}$ and

$$I = I_1 - I_2 = V\left(\frac{1}{R_1 + R} + \frac{1}{R_2 + R}\right) - \frac{V_{DC1} + V_T}{R_1 + R} - \frac{V_{DC2} - V_T}{R_2 + R} \text{ Amper}$$

If $V \leq V_{DC1} + V_T$ then $I_1 = 0, I_2 = \frac{V_{DC2} - V_T - V}{R_2 + R}$ and

$$I = I_1 - I_2 = \frac{V - V_{DC2} + V_T}{R_2 + R} \text{ Amper}$$

1- a) Construct the circuit in Figure 1 on the breadboard. The circuit parameters are as follows: **V_{DC1}=1.5 Volt, V_{DC2}=0 Volt**, R1=2.2 kΩ, R2=1 kΩ, R= 1 kΩ, V_{AC}=8sin(2πft) Volt (For V_{DC1} and V_{DC2} use the small batteries, for V_{AC} use the function generator and take f=1000 Hz). If the channels of oscilloscope are connected as in Figure 3, CH1 will show the total voltage drow over the circuit whereas CH2 will show the total current over the circuit. Hence, when we use x-y operation on the oscilloscope we will observe the V(t) versus I(t) characteristic for the circuit. For both channels (CH1 and CH2) take Volt/Div= 2 Volt. Draw what you have observed on the oscilloscope in x-y mode to Figure 4, indicate the important points in your plot ($V_T \cong 0.7$ Volt).

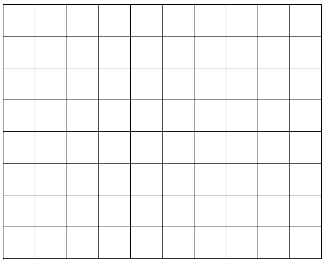

Figure 4: Oscilloscope view when Volt/Div=2 Volt for part 2-a.

b) Construct the circuit in Figure 1 on the breadboard. The circuit parameters are as follows: **V_{DC1}=0 Volt, V_{DC2}=1.5 Volt**, R1=2.2 kΩ, R2=1 kΩ, R= 1 kΩ, V_{AC}=8sin(2πft) Volt (For V_{DC1} and V_{DC2} use the small batteries, for V_{AC} use the function generator and take f=1000 Hz). If the channels of oscilloscope are connected as in Figure 3, CH1 will show the total voltage drow over the circuit whereas CH2 will show the total current over the circuit. Hence, when we use x-y operation on the oscilloscope we will observe the V(t) versus I(t) characteristic for the circuit. For both channels (CH1 and CH2) take Volt/Div= 2 Volt. Draw what you have observed on the oscilloscope in x-y mode to Figure 5, indicate the important points in your plot. ($V_T \cong 0.7$ Volt).

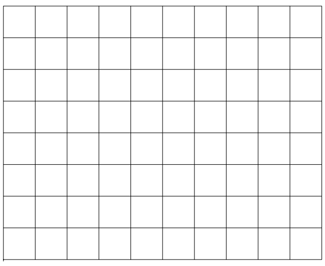

Figure 5: Oscilloscope view when Volt/Div=2 Volt for part 2-b.

c) Construct the circuit in Figure 1 on the breadboard. The circuit parameters are as follows: **V_{DC1}=0 Volt, V_{DC2}=3 Volt**, R1=2.2 kΩ, R2=1 kΩ, R= 1 kΩ, V_{AC}=8sin(2πft) Volt (For V_{DC1} and V_{DC2} use the small batteries, for V_{AC} use the function generator and take f=1000 Hz). If the channels of oscilloscope are connected as in Figure 3, CH1 will show the total voltage drow over the circuit whereas CH2 will show the total current over the circuit. Hence, when we use x-y operation on the oscilloscope we will observe the V(t) versus I(t) characteristic for the circuit. For both channels (CH1 and CH2) take Volt/Div= 2 Volt. Draw what you have observed on the oscilloscope in x-y mode to Figure 6, indicate the important points in your plot. ($V_T \cong 0.7$ Volt).

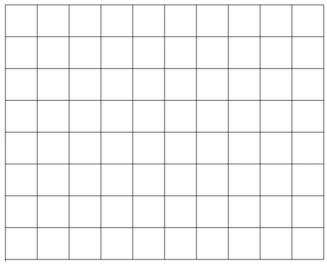

Figure 6: Oscilloscope view when Volt/Div=2 Volt for part 2-c.