CSE 350

Digital Electronics and Pulse Techniques

Lab Report

Experiment No: 06

To Design & Simulate an Astable Multivibrator Circuit

Submitted by:

Name – Fariha Rahman

ID - 19101038

Section - 04

Department - CSE

Fall 2021

BRAC UNIVERSITY

Objective:

The objective of this experiment is to analyze an astable multivibrator.

Equipment:

1. Trainer board
2. Transistor: 2(unit)
3. Resistors: 4(unit), R2 = R3 = 4.7K, R1 = R4 = 1K
4. Capacitor: 2(unit) = 4.7μF

Circuit Diagram:

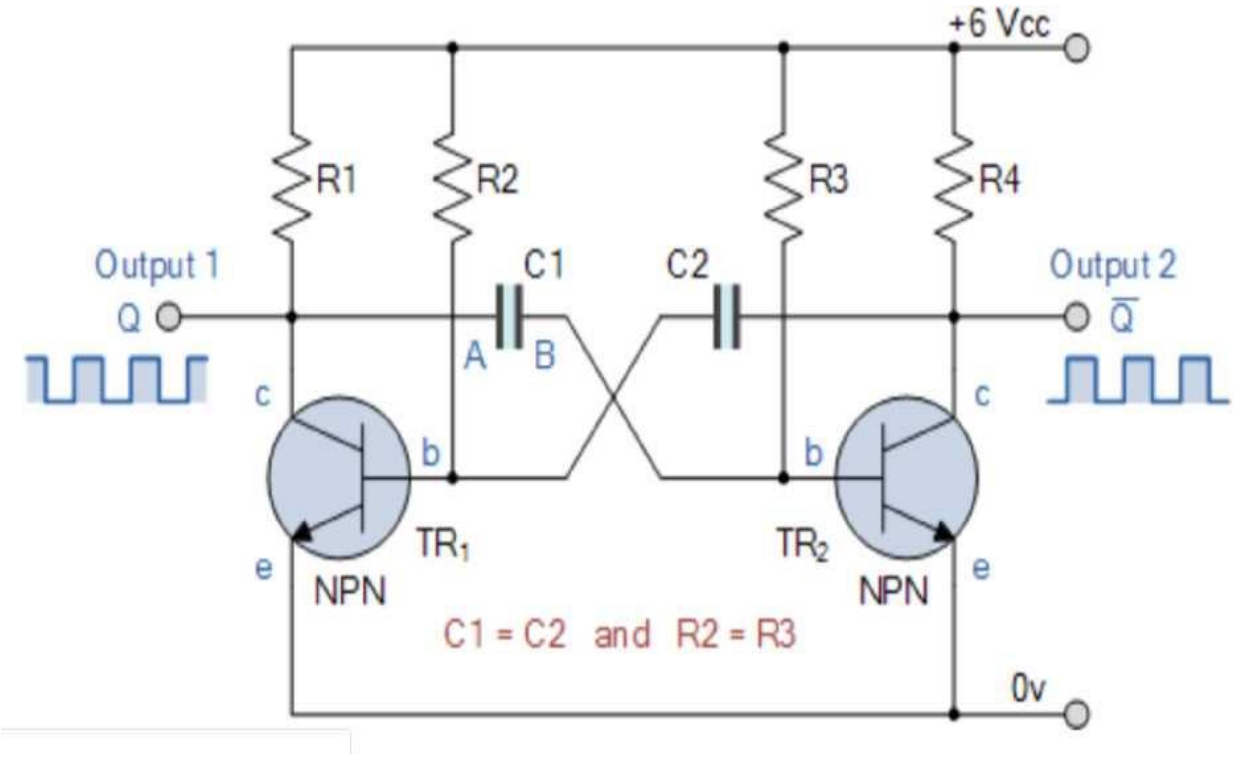
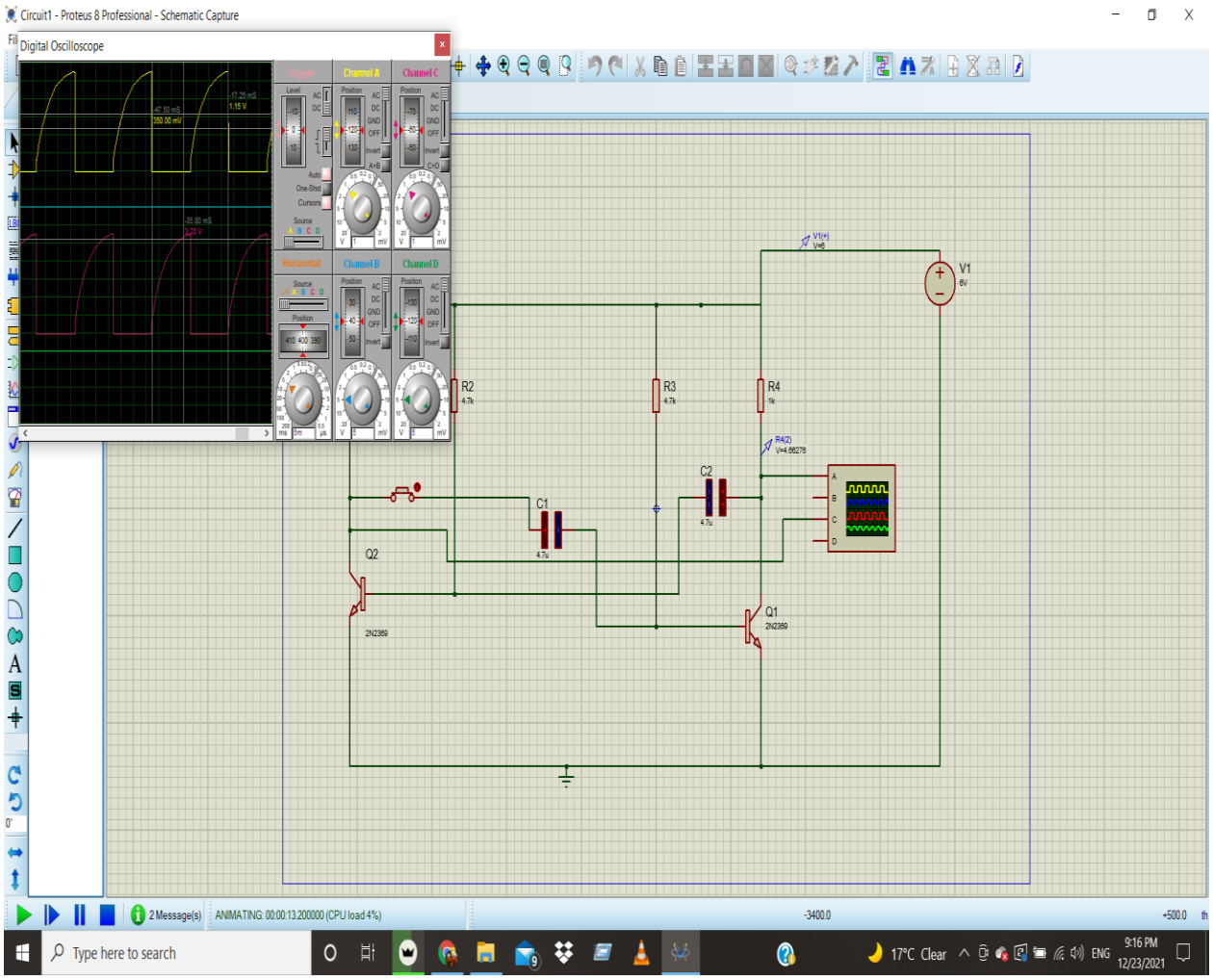


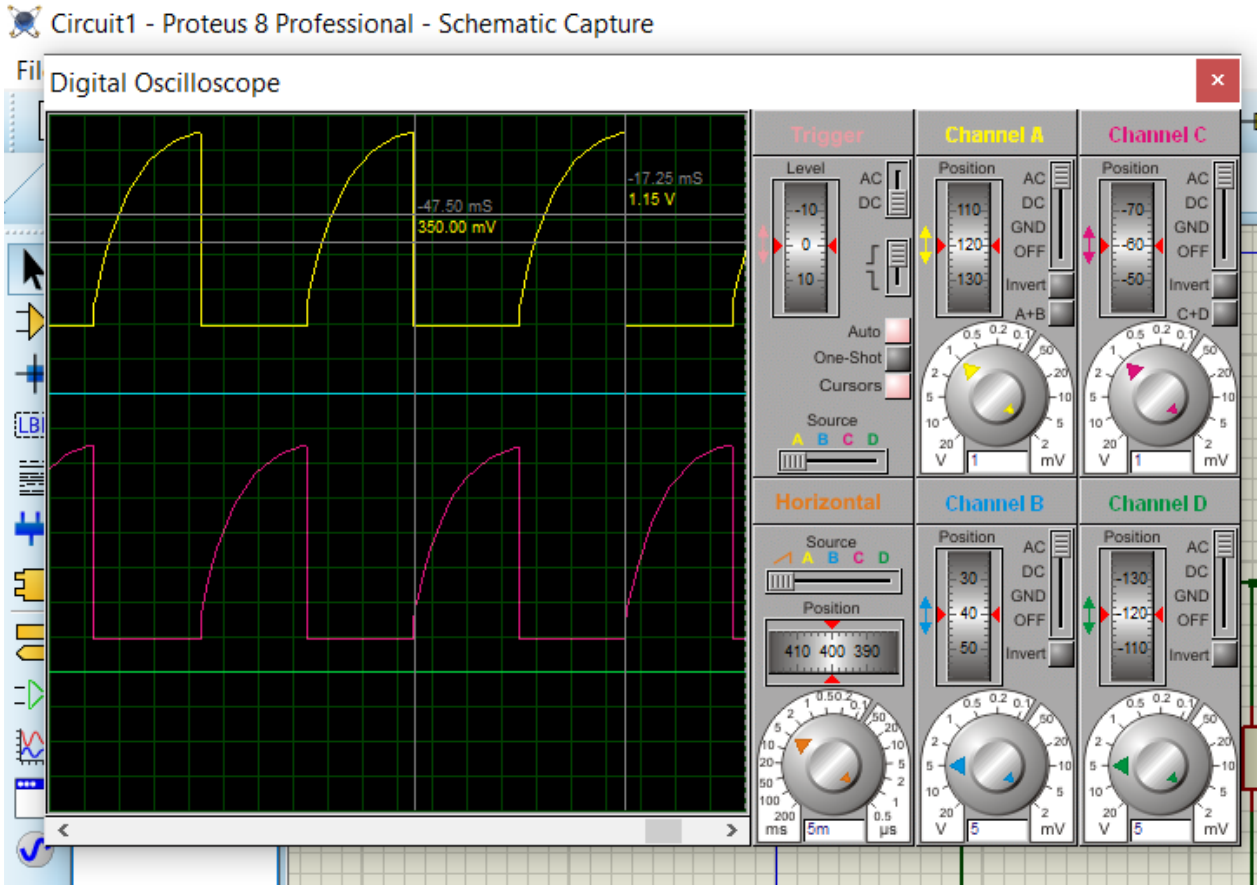
Figure 1: Astable multivibrator circuit.

Circuit:

Circuit 01



Digital Oscilloscope



ID-19101038

(1)

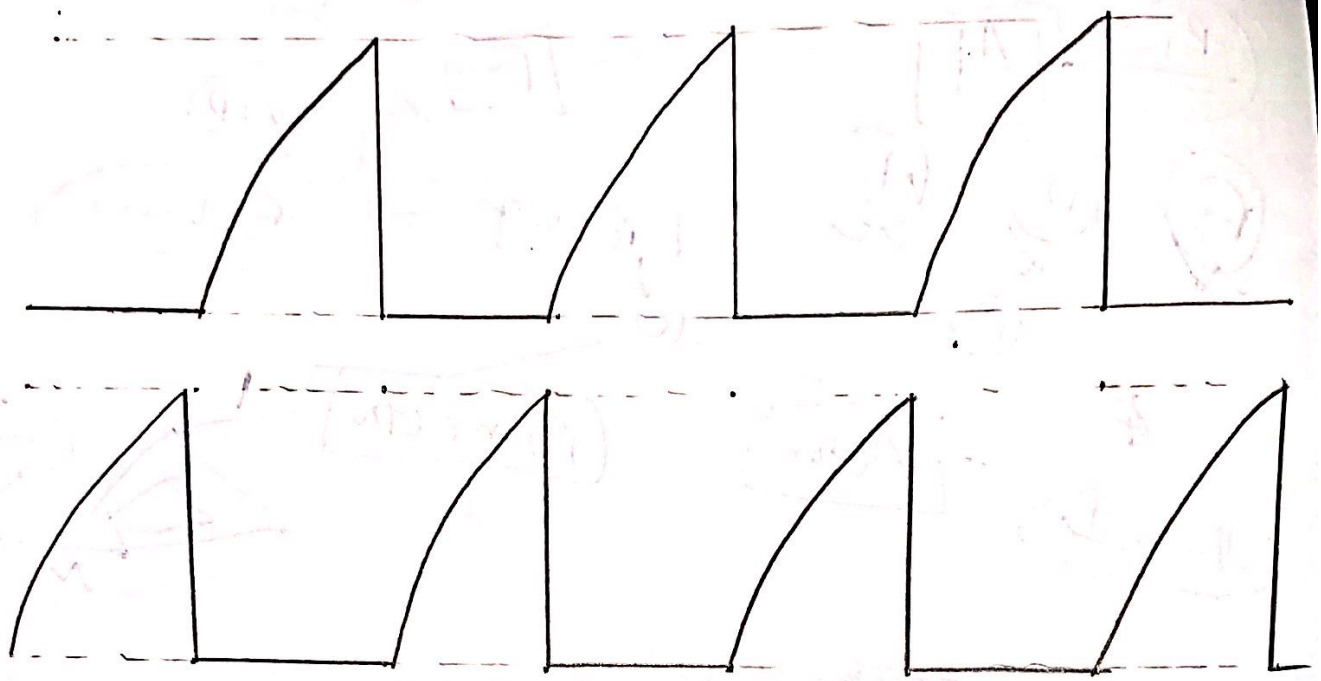


Figure: Output waves forms in the proteus simulation

(2) Yes, there are deviation in the experiment output wave shape from the desired wave. In this experiment, we observe that, the output wave is not exactly square. It happened due to the changing characteristics of capacitor which is cross-coupled circuit. In here, the discharging time constant of the capacitor is smaller than the changing time constant. In terms of changing, the value of the resistance is large and it needs same time to change. But in terms of discharging the value of base resistor is too low, so it needs less amount of time than changing. So, for any time frame, discharging time constant < Changing time constant. That's why we did not get our output as desired wave.

ID-19101038

(3) We know, theoretically,

$T = t_1 + t_2$

So, $t_1 = 0.69 \times R_3 \times C_1$

$= 0.69 \times 4.7 \times 10^3 \times 4.7 \times 10^{-6}$

$= 0.0152421$

Again, $t_2 = 0.69 \times R_2 \times C_2$

$= 0.69 \times 4.7 \times 10^3 \times 4.7 \times 10^{-6}$

$= 0.0152421$

So, $T = t_1 + t_2 = 0.030482$ ms

Here,

$C_1 = C_2 = 4.7 K\Omega$

$R_2 = R_3 = 4.7 K\Omega$

from experiment,

$T = T_2 - T_1 = (47.5 - 17.25)$ ms

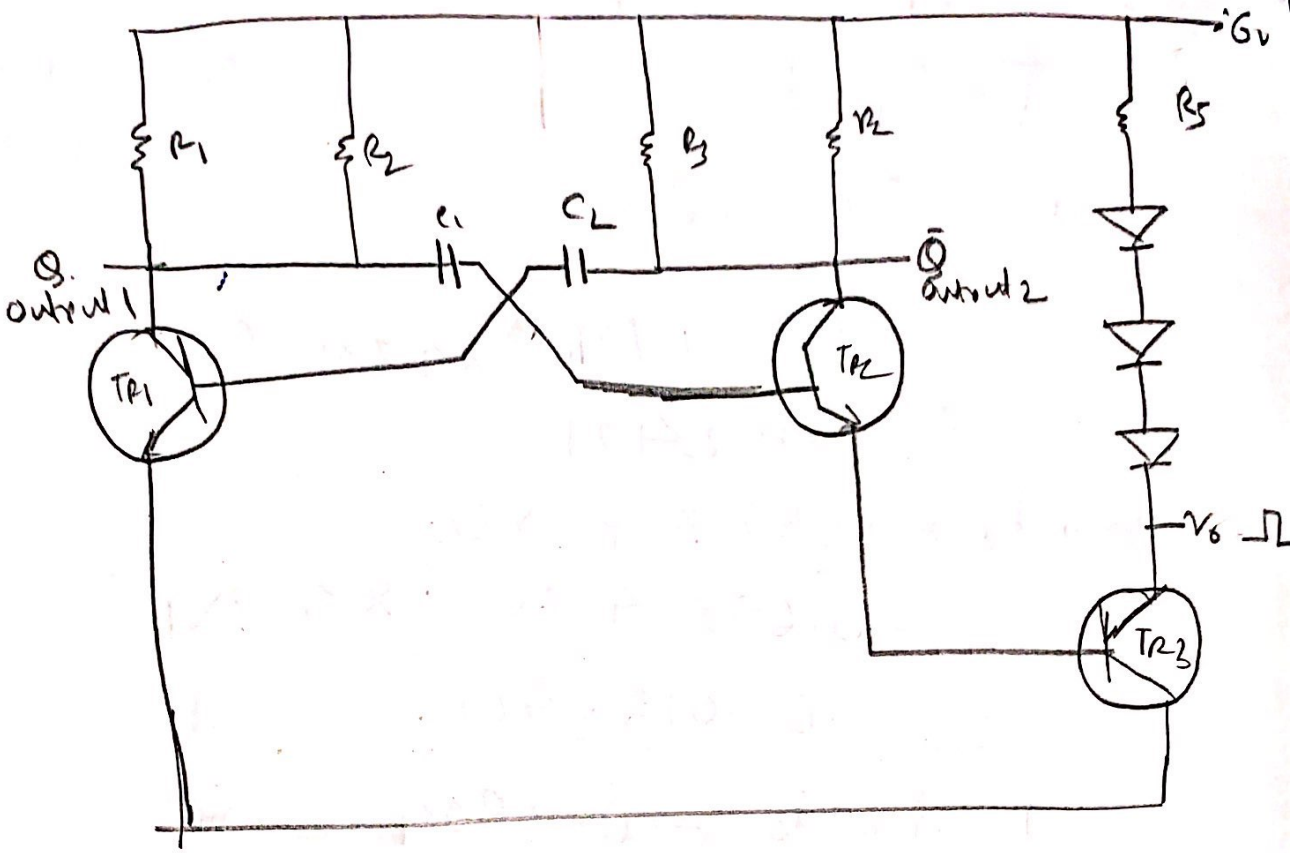
~~(32.75 - 32.50) ms~~

$= 30.25$ ms

$= 0.030255$

So, we can say that although there's a slight difference of 0.02 ms, & the values are close to the theoritacal time. So, the values are almost similar.

(4) ID- 19101038



Yes, it is possible to use a multivibrator to create variable frequency wave generation.

From, V_0, we get a almost perfect square curve. TR_2 is connected to TR_1, so, when TR_2 in cutoff mode, TR_3 wil also be in cut off mode. When TR_3 is in saturation, TR_3 will also be in saturation mode.

In the given astable multivibrator, we get curved wave output pulse because of changing characteristics of the capacitor in the cross-coupled circuit. But here, there is no capacitor connected with TR_3. So, here we use an additional transistor TR_3

to switch Light Emitting Diodes, Relays on to produce a sound from a sound Trasducer. So, we can say that, it will generate almost square wave.

(5) We know, $t_1 = 0.015242$,

$t_2 = 0.015242$

$T = 0.030482$ ms

$= 30.482$ ms

And, Duty cycle, $D = \frac{t_1}{T} \times 100\%$,

So, if we fix the value of capacitor and change the value of R_3, then,

(i) R_3 increases → Duty cycle increases

(ii) R_3 decreases → Duty cycle decreases

So, $D \propto t_1$ and $t_1 \propto R_2$ and $t_1 \propto C_1$.

So, by changing the value of R_3 and C_1 we can change the duty cycle of the circuit.