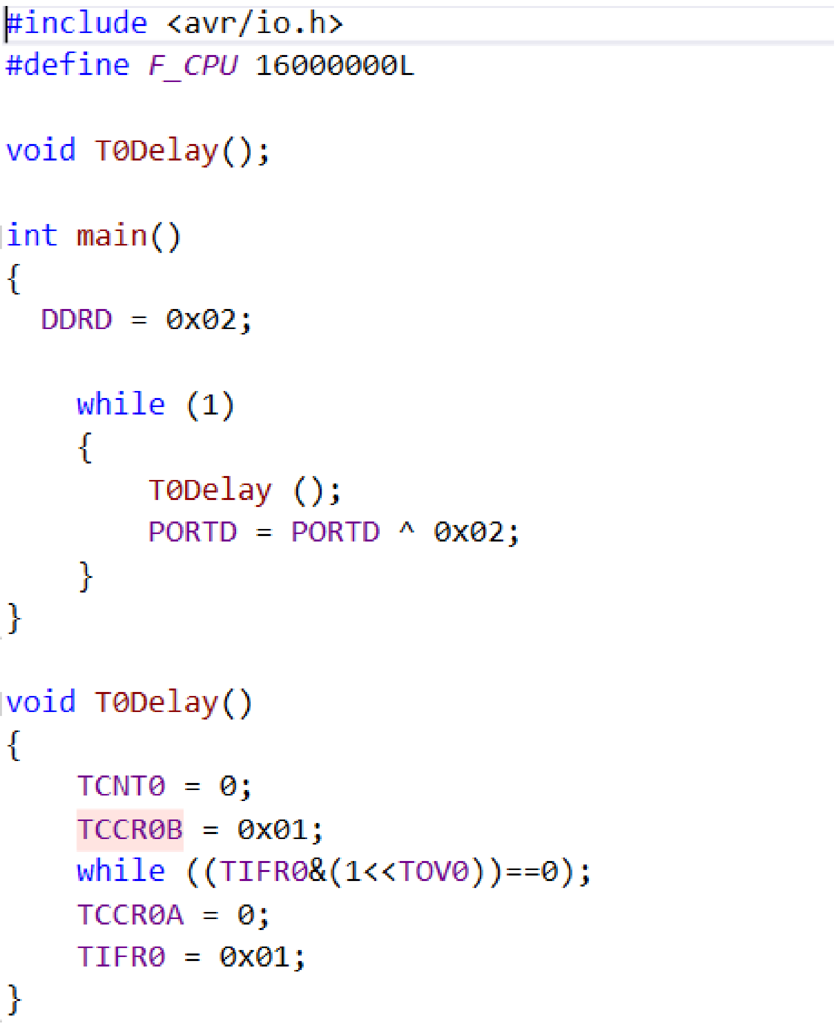
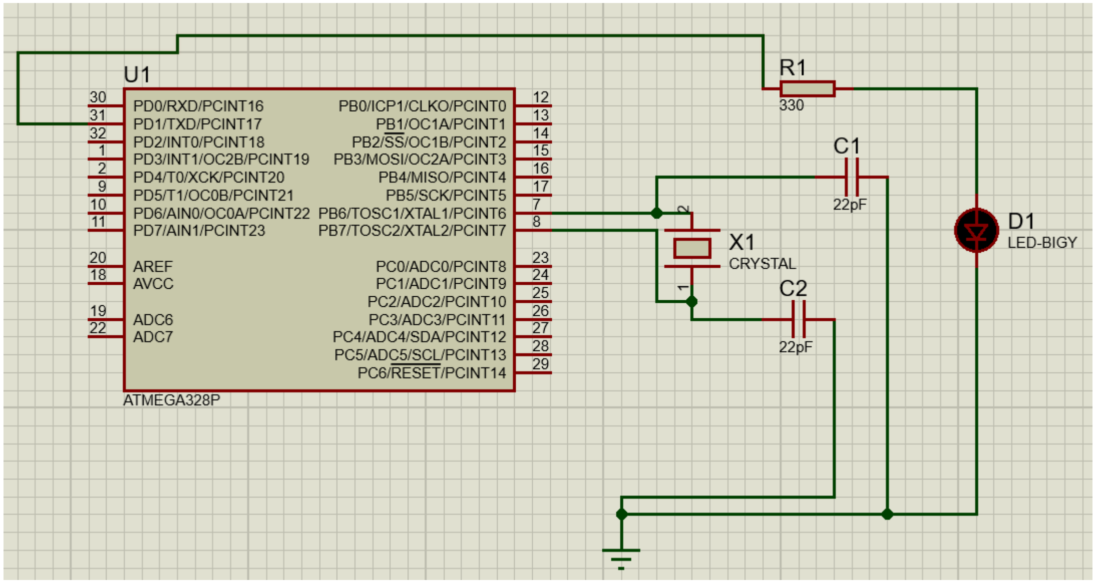
**Lab Task 4: Write the following code in main.c file**



```
#include <avr/io.h>
#define F_CPU 16000000L

void T0Delay();

int main()
{
  DDRD = 0x02;

     while (1)
     {
         T0Delay ();
         PORTD = PORTD ^ 0x02;
     }
}

void T0Delay()
{
     TCNT0 = 0;
     TCCR0B = 0x01;
     while ((TIFR0&(1<<TOV0))==0);
     TCCR0A = 0;
     TIFR0 = 0x01;
}
```

Implement the circuit for this code in proteus as shown below



**Lab Task 5:**

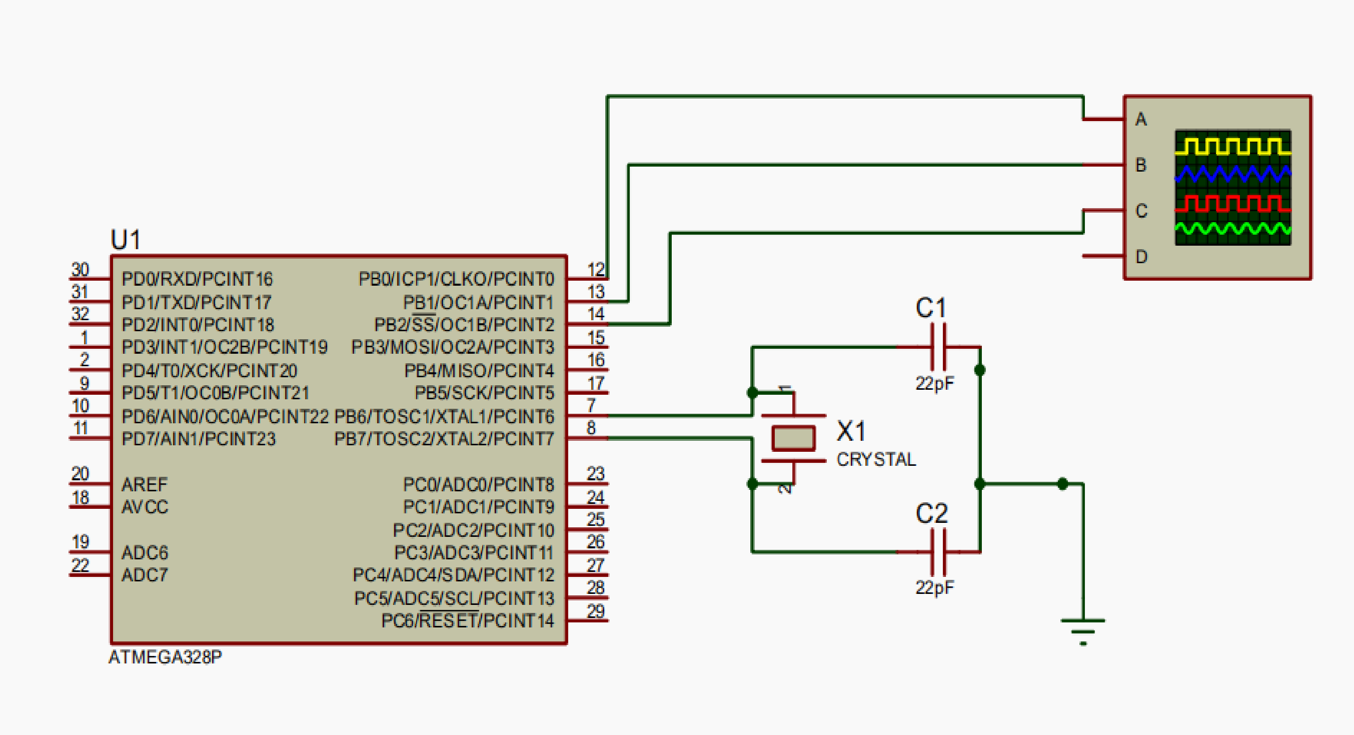
Generate the square waves of 25%, 50% and 75% duty cycle using timer function and display the waveform across oscilloscope. Use PortB pin 0, 1 and 2 for output and complete this task in a single program. Implement the circuit on the breadboard and show the results on oscilloscope to lab instructor. Attach your code, proteus simulation, hardware and oscilloscope results below.

## *Code :*

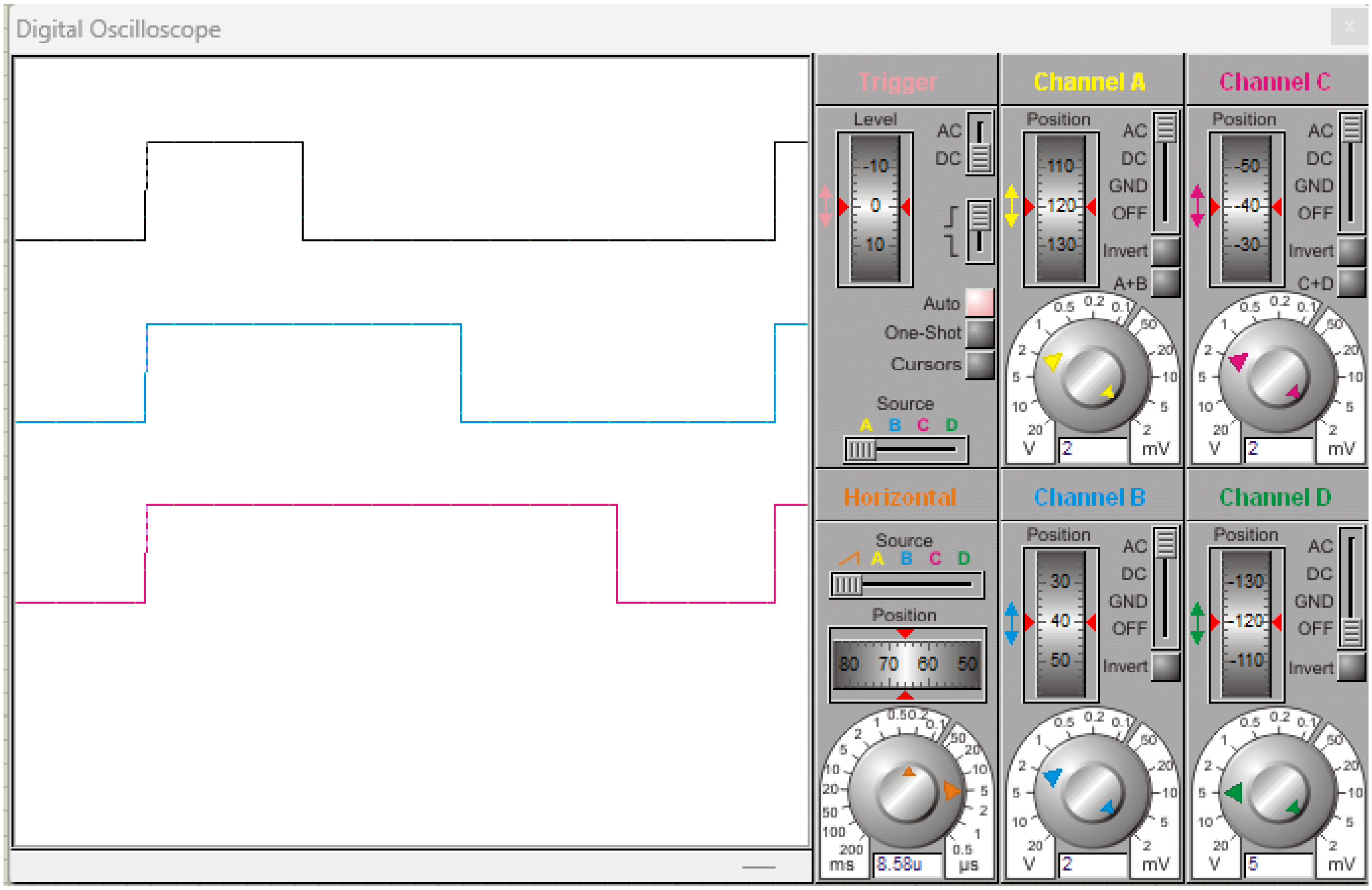
```
/*
 * Lab_08_Task_05.cpp
 *
 * Created: 6/6/2023 2:54:25 PM
 * Author : fahim
 */

#include <avr/io.h> // Include the AVR IO library for accessing registers and I/O operations
#define F_CPU 16000000UL // Define the frequency

void T0Delay(); // Function prototype for delay using Timer0

int main(void)
{
       DDRB = 0b00000111; // Set PORTB pins 0, 1, and 2 as output

       while (1) // Infinite loop for Square Wave
       {
              PORTB = 0b00000111; // Set PORTB pins 0, 1, and 2 to high
              T0Delay(); // Delay of ( 25% of the square wave ) using Timer0
              // Set PORTB pins 1 and 2 to high, pin 0 to low ( Pin 0 will give 25% duty cycle
              square wave )
              PORTB = 0b00000110;
              T0Delay(); // Delay of ( 25% of the square wave ) using Timer0
              // Set PORTB pin 2 to high, pin 0 and pin 1 to low ( Pin 1 will give 50% duty cycle
              square wave )
              PORTB = 0b00000100;
              T0Delay(); // Delay of ( 25% of the square wave ) using Timer0
               // Set PORTB pins 1 , 2 and 0 to low ( Pin 2 will give 75% duty cycle square wave)
              PORTB = 0b00000000;
              T0Delay(); // Delay of ( 25% of the square wave ) using Timer0
              // Now one Square wave is completed
       }
}

void T0Delay()
{
       TCNT0 = 0;      // Reset Timer0 counter
       TCCR0B = 0x01;  // Start Timer0 normal mode
       while ((TIFR0 & (1 << TOV0)) == 0); // Wait for Timer0 overflow flag to be set
       TCCR0A = 0;   // Reset Timer0 control register A
       TIFR0 = 0x01; // Clear Timer0 overflow flag
}
```

## *Circuit:*

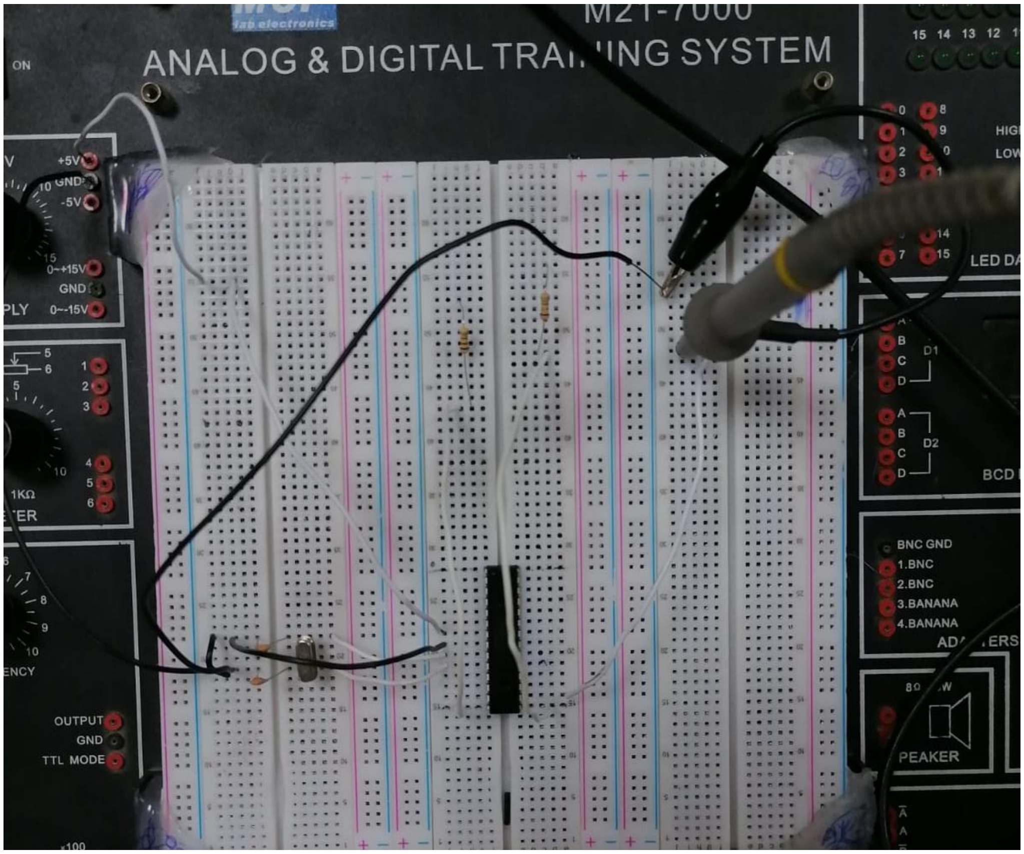
### *1) Simulation ( Proteus ) :*



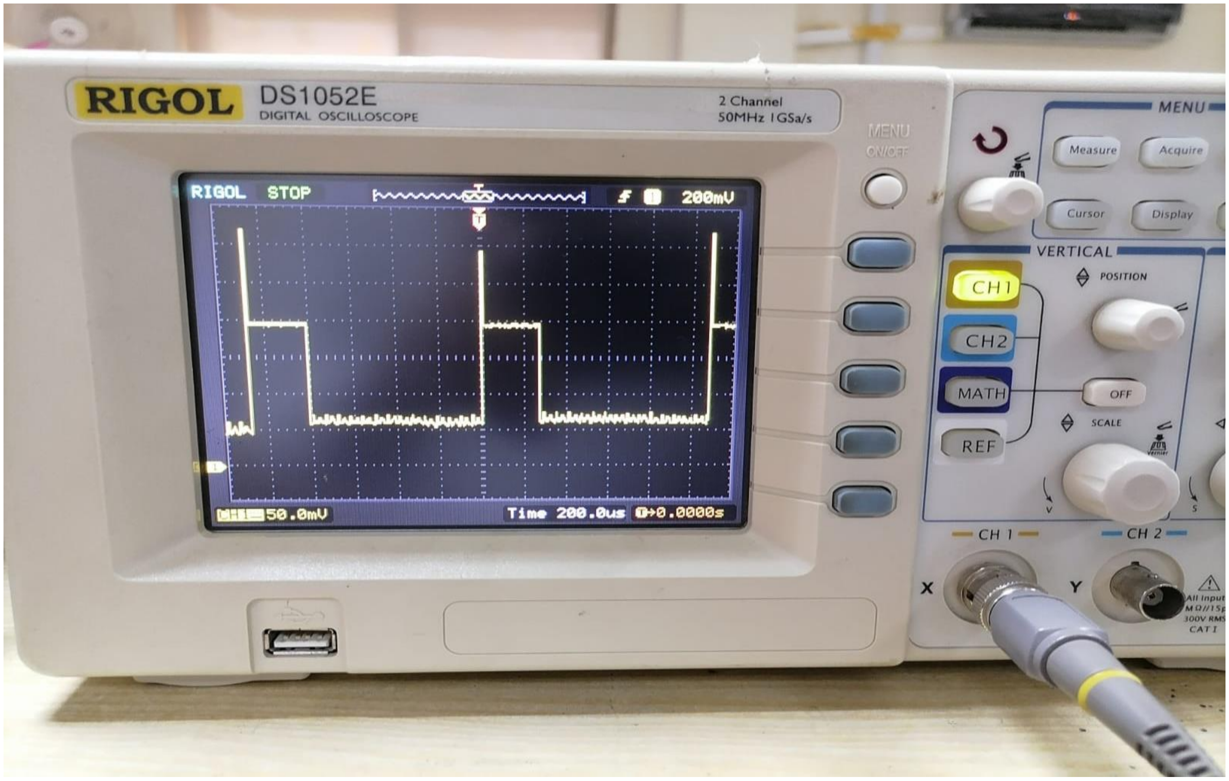
## *Output :*

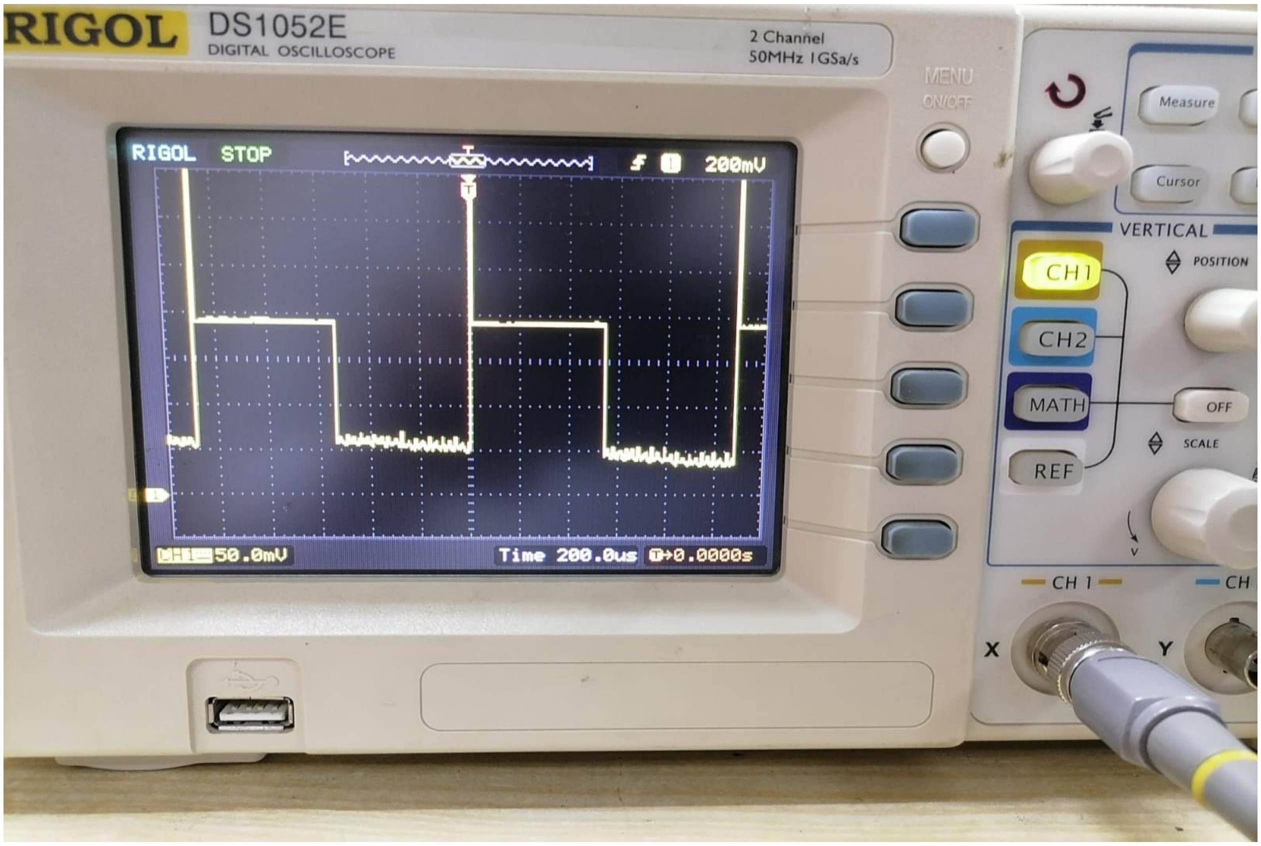


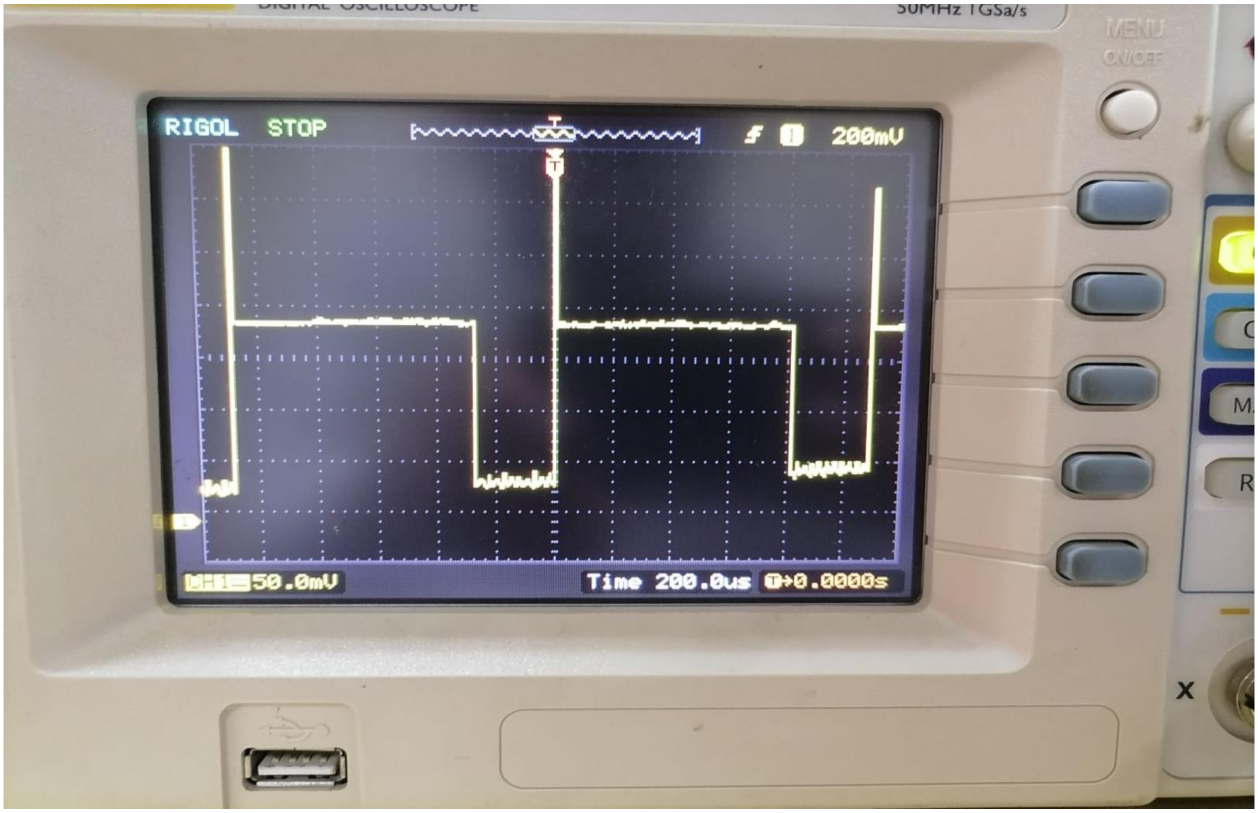
### *2) Hardware (Hardware ) :*



### *Output :*




RIGOL DS1052E
DIGITAL OSCILLOSCOPE
2 Channel
50MHz 1GSa/s
RIGOL STOP
200mV
CH1 50.0mV
Time 200.0us
T→0.0000s
MENU
ON/OFF
Measure
Cursor
VERTICAL
POSITION
CH1
CH2
MATH
REF
OFF
SCALE
CH 1
CH
X
Y


DIGITAL OSCILLOSCOPE
50MHz 1GSa/s
MENU
ON/OFF
RIGOL STOP
200mV
CH1 50.0mV
Time 200.0us
T→0.0000s
X

## Answer the following questions:

1. Explain the code written in lab task 1. What does the code do? Did you learn anything new in lab task 1?

ANS : This was an introductory code of C language for AVR Atmega 328P in which portb pin 0 was moniterd for led .AVR input output header file was included at the first line ,Then the CPU frequency was defined which is 16MHz and also predefined delay function of AVR is included. After that the main syntax of C language , where firstly portb is set for out and then while loop which is always true for portb pin 0 ,at first it was high for 500ms then it is low for 500ms and repeat infinitely.

This code toggle LED on pin 0 of portb of Atmega328p for 500ms.

Yes we learn the basic of C language ,also leaned that for AVR frequency we define it in the code ,we also leaned that C language is too much easy for AVR.

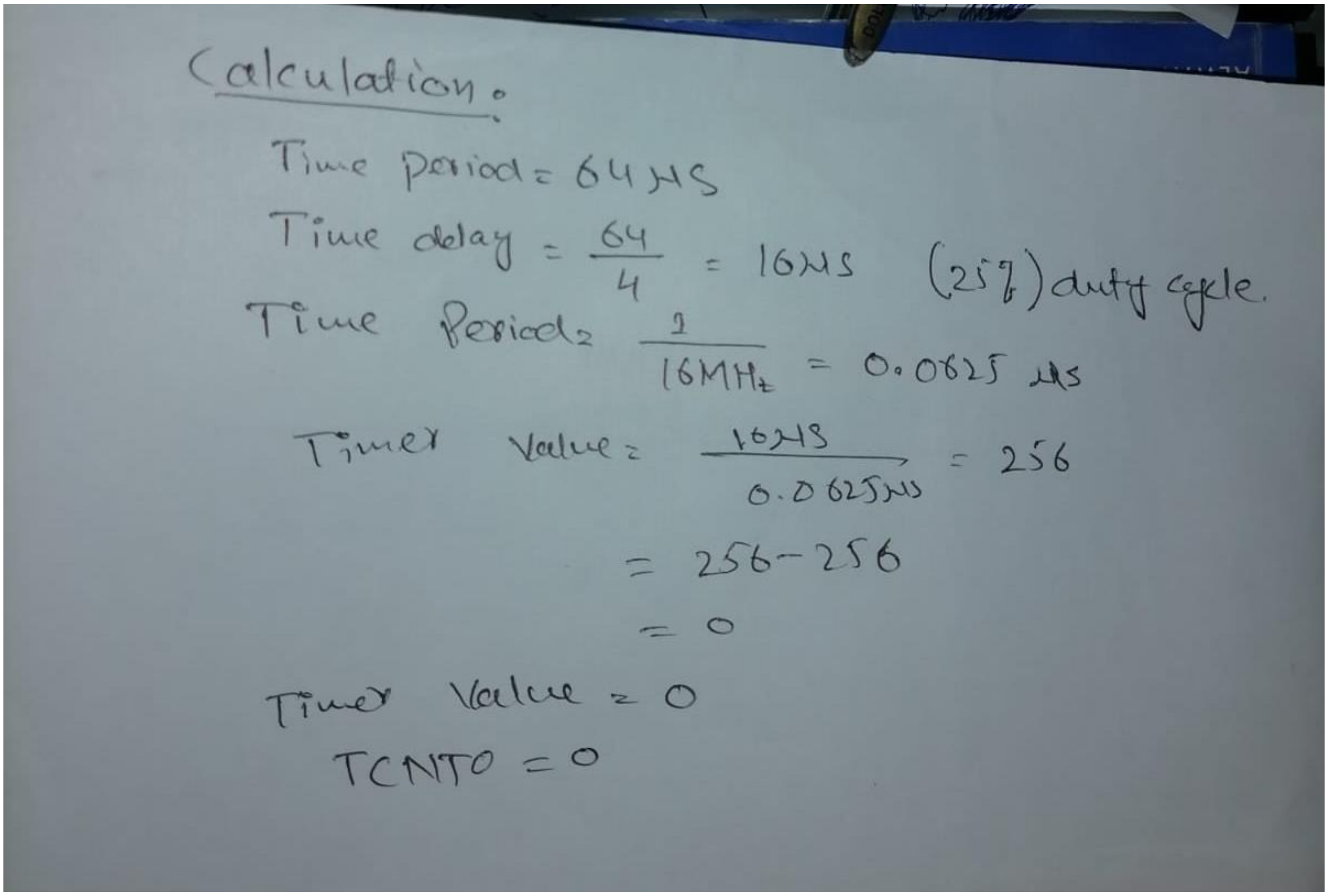
2. Explain the code given in lab task 4. What does the code do? What difference did you observe between what we studied in class and what you executed in lab?

ANS : This C code is for toggling the LED connected at pind 1. Here for delay the Timer0 is used , in which TCNT is 0 and no prescalur is defined , timer0 is normal mode .

This Code toggling the portd pin 1 with Timer0 delay.

The difference we observed that in class we use the timer counter as TCNT while here we used it as TCNT0 . Also timer cotrole as TCCR in class while here it was TCCR0B.

3. In lab task 5, what is the time period and frequency of square wave you have generated on PC2, PC3 and PC4? Show the calculation below



Calculation:

Time period = 64 μs

Time delay = $\frac{64}{4}$ = 16μs (25%) duty cycle.

Time Period = $\frac{1}{16MHz}$ = 0.0625 μs

Timer Value = $\frac{16\mu s}{0.0625\mu s}$ = 256

= 256 − 256

= 0

Timer Value = 0

TCNT0 = 0