

ECE302 Embedded Systems Design

Section 1 Monsoon Semester 2021

ESD Lab Report 3.



Ahmedabad
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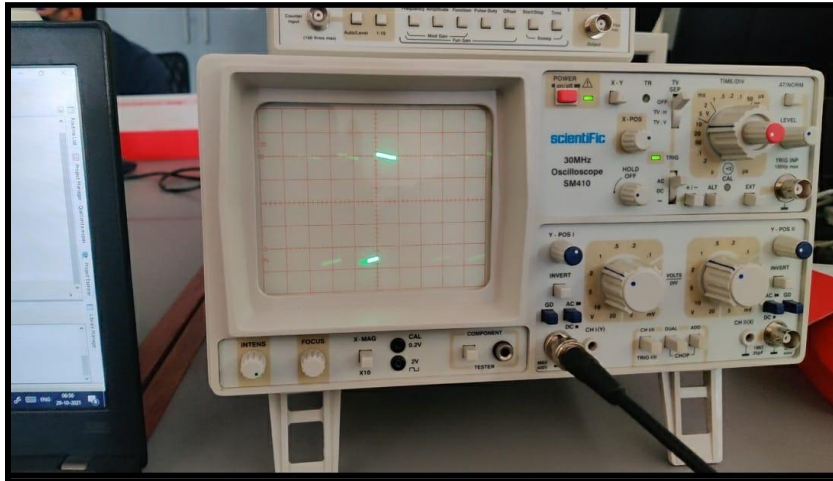
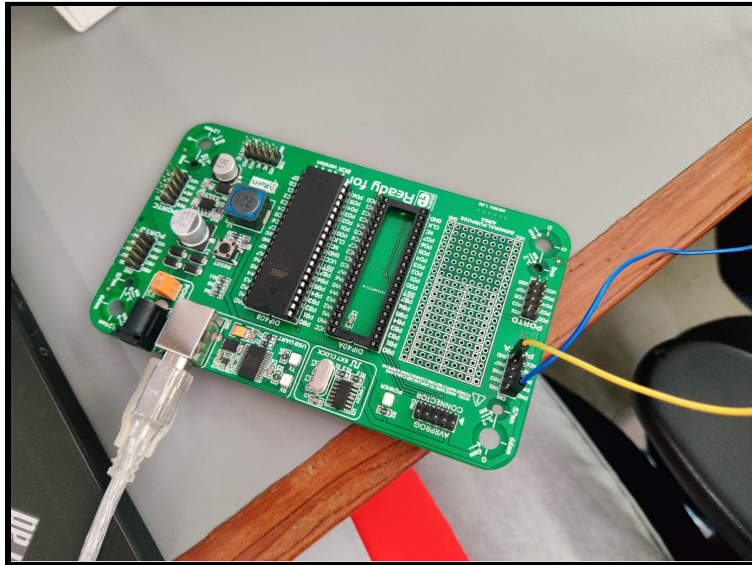
Submitted By: Kavya Patel AU1940144

Question 1: Toggle a port pin upon stated conditions:

A) Timer 1 Normal mode

Each time timer overflow flag is generated.

Timer count: 0 -> 65535.



Code:

```
void T1Delay()
```

```
{
```

```
    TCCR1A = 0x00;
```

```
    TCCR1B = 0x01;
```

```
    TCNT1H = 0x00;
```

```

TCNT1L = 0x00;

while((TIFR & 0x04) == 0);
TIFR = 0x04;
TCCR1A = 0x00;
TCCR1B = 0x00;
}

void main() {
    DDRA = 0x01;
    while(1)
    {
        PORTA ^= 0x01;
        T1Delay();
    }
}

```

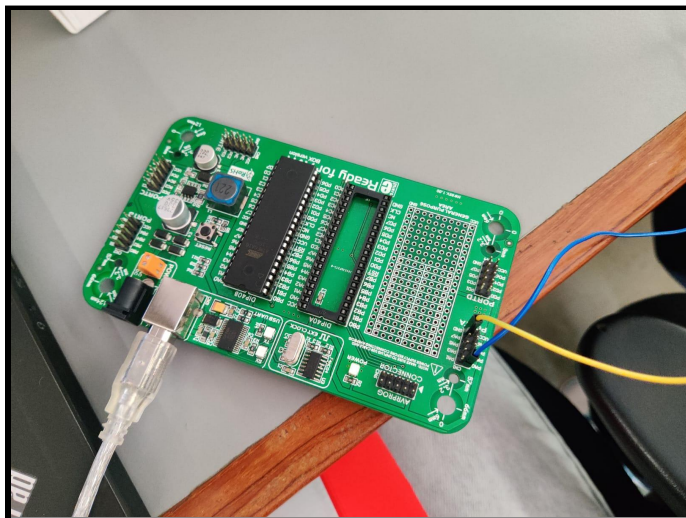
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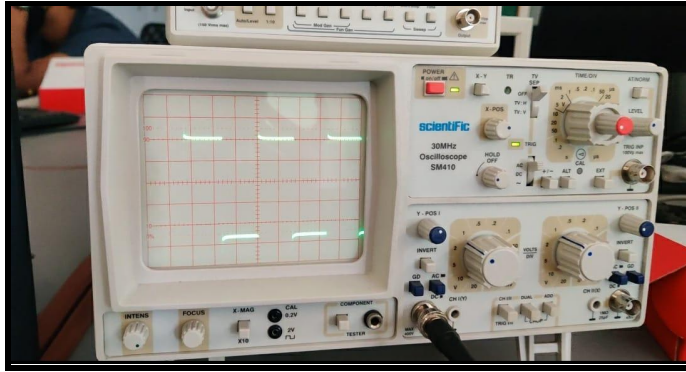
In this experiment, we had to run timer1 with a full cycle (TCNT will count from 0 to 65535). Also since timer1 circuit is used, it has 16-bit registers, and hence its value is set in two lines according to two 8-bit registers. The PORT.b0 of the microcontroller is connected to the red wire of the alligator and the black is connected to ground. The calculated value of frequency is 50 Hz i.e. 5 ms for 4 blocks gives 20ms.

B) Timer 1 CTC mode

Each time timer compare flag is generated.

Timer count: 0 -> 235.





Code:

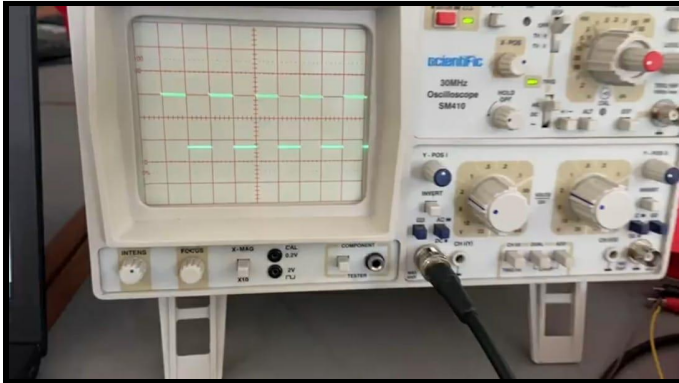
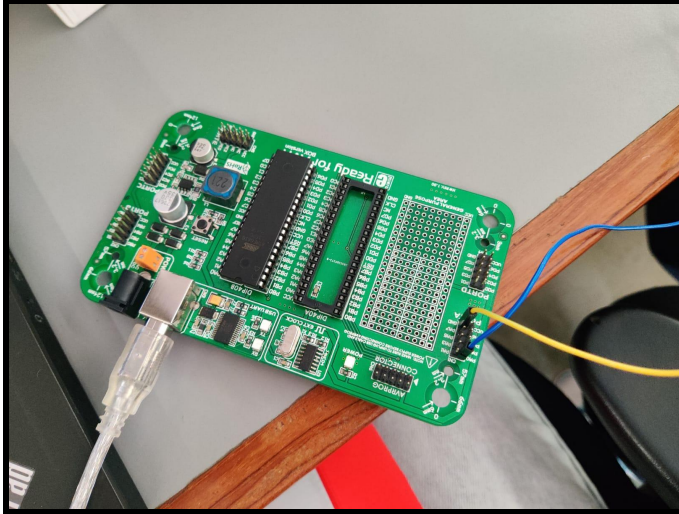
```
void T1Delay()
{
    TCCR1A = 0x00;
    TCCR1B = 0x09;
    TCNT1H = 0x00;
    TCNT1L = 0x00;
    OCR1AL = 235;
    OCR1AH = 0x00;

    while((TIFR & 0x08) == 0);
    TIFR = 0x08;
    TCCR1A = 0x00;
    TCCR1B = 0x00;
}

void main() {
    DDRA = 0x01;
    while(1)
    {
        PORTA ^= 0x01;
        T1Delay();
    }
}
```

Description: This is similar to the above experiment, with a difference that timer1 is in CTC mode and not in normal mode. Thus we calculate the value of OCR and TCCR is set accordingly. Here, the calculated frequency is 14 kHz.

Question 2: Generate and verify square wave of 1 kHz frequency at a port pin using Timer 1 using 2 different prescalers.



Code:

```
T1Delay()
```

```
{
```

```
    TCNT1L = 0x0B;
```

```
    TCNT1H = 0xFE;
```

```
    TCCR1B = 0x02;
```

```
    TCCR1A = 0x00;
```

```
    while((TIFR & 0x04) == 0);
```

```
    TIFR = 0x04;
```

```
    TCCR1A = 0;
```

```
    TCCR1B = 0;
```

```
}
```

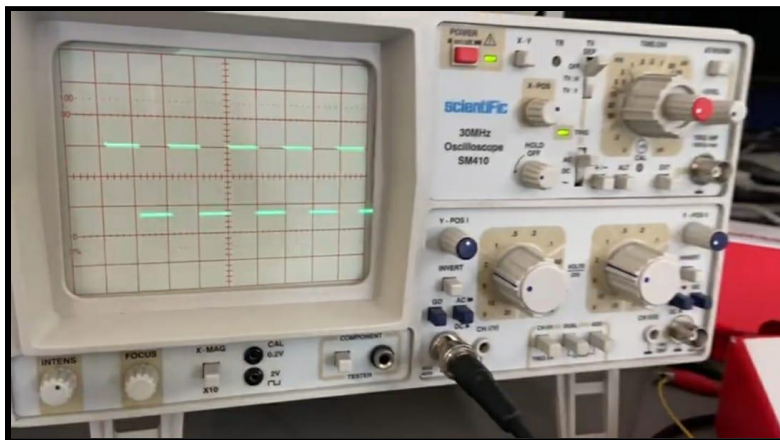
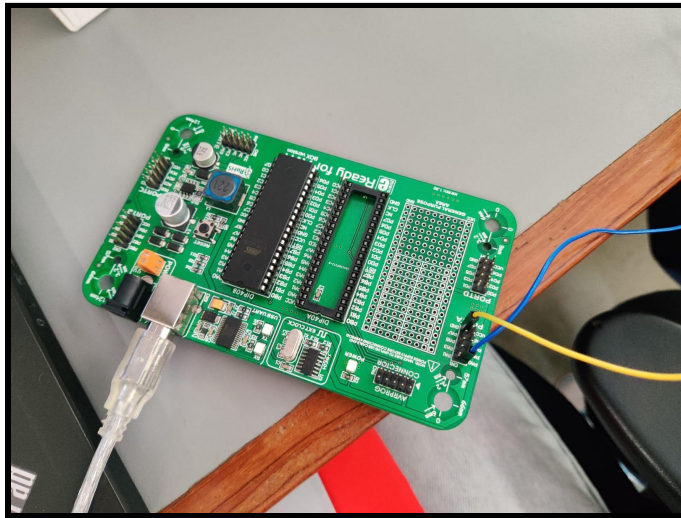
```
void main() {
```

```

DDRA = 0x01;
while(1)
{
    PORTA ^= 0x01;
    T1Delay();
}
}

```

Part 2:



```

T1Delay()
{
    TCNT1L = 0xF1;
    TCNT1H = 0xFF;
    TCCR1B = 0x04;
    TCCR1A = 0x00;

    while((TIFR & 0x04) == 0);
}

```



```

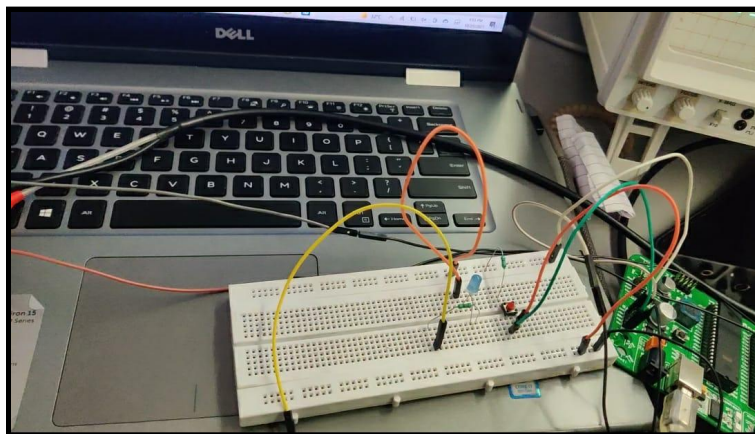
TIFR = 0x04;
TCCR1A = 0;
TCCR1B = 0;
}

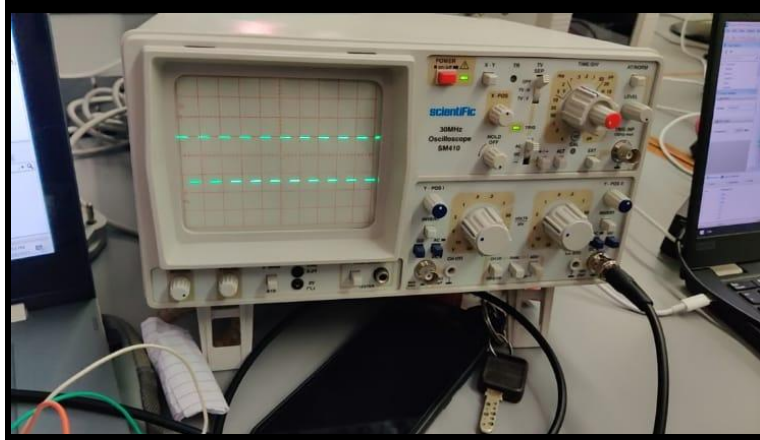
void main() {
    DDRA = 0x01;
    while(1)
    {
        PORTA ^= 0x01;
        T1Delay();
    }
}

```

Description: We had to generate one square wave using two different prescaler and timer1 circuits. The end result of both the prescaler will remain the same. The time delay for the square wave is 1kHz so, the time delay is 1ms for 1 full cycle and for the half-cycle is 0.5ms. Circuit is similar to that of the previous question.

Question 3: Generate and verify square wave at pin PORTA.A0 of frequency 2 KHz using timer 0 interrupt, simultaneously use PORTB.B0 to take input using push button and display it using led on PORTB.B1(Display High/Low state of switch at B0).





Code:

```
void main() {
    DDRA = 0x01;
    DDRB = 0x01;

    TCCR0 = 0x02;
    TCNT0 = 6;

    TIMSK = 0x01; // Local
    SREG.b7 = 1; // Global

    while(1)
    {
        PORTB.b0 = PINB.b1;
    }
}

void timer0_ovf_isr(void) __attribute__((interrupt))
{
    PORTA ^= 0x01;
    TCNT0 = 6;
}
```

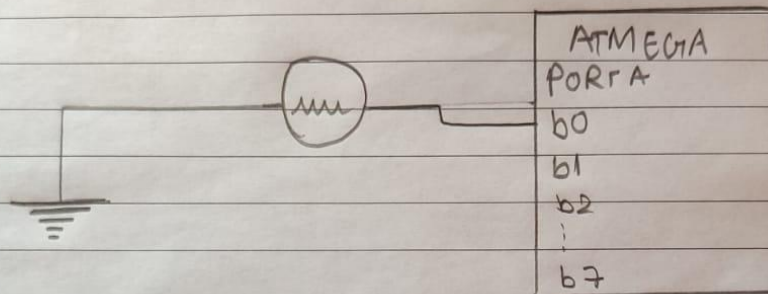
Description: In this experiment, we had to generate a square wave at PORTa.b0 of frequency 2 kHz. Hence the time delay for full cycle will be 1ms. We also had to take input from PORTB.b0 using a push-button switch and display it using led on PORTB.b1 at the same time. This can be achieved using an interrupt which is called every time timer1's overflow flag turns on while simultaneously reading a value from PORTB.b0 and sending it to PORTB.b1. For generating a square wave we will also have to connect the circuit similar to that in the previous two experiments.

Page No.:	

AV1940144 Kanya Patil
ESD lab assignment 3.

Circuit Diagrams:

→ For question 1(A), 1(B) and 2.



→ For Question 3.

