IET WINTER 2016
Embedded Systems Design
LAB 3

Objective:

At completion of the lab, student will be able to:

1. Get basic understanding of 8 Bit Timers.
2. Understand and program Timer 0 & Timer 2 of Atmega 16/32.

Components Required for the Lab:

1. Development Board from MikroElectronika
2. USB cable for programming Atmega 16
3. Breadboard
4. Assorted wires
5. Connectors (for development board to breadboard connections)
6. CRO

LAB -3 Resources:

1. Atmega 16 Vector Table Page No:45
2. Atmega 16 Timer0 Datasheet
3. Atmega 16 Timer2 Datasheet
4. Brief summary of 8-bit timer Datasheet

Some useful Registers for this lab:

TCNT0/2   -   Timer/Counter Register

OCR0/2   -   Output Compare Register

TCCR0/2   -   Timer/Counter Control Register

TIMSK   -   Timer/Counter Mask Interrupt Register

TIFR   -   Timer/Counter Interrupt Flag Register

SREG   -   Status Register

Lab Assignment:

Write and test following programs:

1. Toggle a port pin upon stated conditions:

   (A) Timer 0 Normal mode

   Each time timer overflow interrupt is generated.
   Timer count: 0 -> 255.

   (B) Timer 0 CTC mode

   Each time timer compare interrupt is generated.
   Timer count: 0 -> 100.

   Calculate and verify the frequency for each case. You may write the values of these frequencies at start of your program (in comment) for submission.

2. Generate and verify square wave of following frequency at a port pin:
   a. **1 KHz**
      (Hint: Setup Pre-scaler)

   b. **1 Hz**
      (Hint:
      If Pre-Scaler is not sufficient to generate the required delay, one could call the same delay multiple times. i.e. if a task occurs every 1000msec and interrupt is called every 10msec. In this case interrupt can be called for 100 times and after the 100th time the task can be performed.)

3. Generate both square waves of problem-2 simultaneously at two different port pins.
   (Hint: You may use Timer 0 and Timer 2 together)

4. (Extra program)
   Generate two square waves with frequency of 1 KHz that are 90° phase shifted.