

# **IET WINTER 2016**

## **Embedded Systems Design**

### **LAB 4**

#### **Objective:**

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

1. Get basic understanding of 16 Bit Timers.
2. Understand and program Input capture Unit of Atmega 16/32.

#### **Components Required for the Lab:**

1. Development Board from MikroElektronika
2. USB cable for programming Atmega 16
3. Breadboard
4. LEDs/Resistors
5. CRO
6. Function Generator
7. Assorted wires/Connectors/CRO Probes

#### **LAB -4 Resources:**

1. Atmega 16 Vector Table Page No:45
2. Atmega 16 Timer1 Datasheet
3. Example code (Time period measurement)
4. Calculation technique for Period measurement (from Embedded C Programming and Atmel AVR, by Barnett, Cux & O'Cull)

#### **Some useful Registers for this lab:**

<b>TCNT1 H/L</b>	- Timer/Counter Register
<b>OCR1A H/L</b>	- Output Compare 1 Register A
<b>OCR1B H/L</b>	- Output Compare 1 Register B
<b>ICR1 H/L</b>	- Input Capture Register 1
<b>TCCR1A H/L</b>	- Timer/Counter 1 Control Register A
<b>TCCR1B H/L</b>	- Timer/Counter 1 Control Register B
<b>TIMSK</b>	- Timer/Counter Mask Interrupt Register
<b>TIFR</b>	- Timer/Counter Interrupt Flag Register
<b>SREG</b>	- Status Register

## **Lab Assignment:**

**Write and test following programs:**

1. Toggle a port pin upon stated conditions:

### **(A) Timer 1 Normal mode**

Each time timer overflow interrupt is generated.  
Timer count: 0 -> 65535.

### **(B) Timer 1 CTC mode**

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

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 1Hz frequency at a port pin using **Timer 1 using 2 different prescaler.**
3. **Time Period Measurement**  
Measure the time period of the given signal and display the value in milli sec @ PORTA.  
(Input Signal frequency: 1Khz – 4 khz , Prescaler - 8)
4. **Regenerate Input Square Signal**  
Measure the time period of input signal with given frequency and regenerate the input signal at PORT pin.  

<b>Input</b>	: Square Wave created by Function Generator
<b>Output</b>	: PORTA.0

You may verify your output at CRO by changing various frequencies.

**(Please make sure that you do not give voltage more than 5Volts to any Microcontroller pin.)**