Farmingdale State College

Department of Electrical Engineering Technology

**EET-251 Microprocessors Spring 2019 Prof. Cernuto**

**Lab #6 Frequency (Clock) Generator 100KHz**

**Design a program to generate a square wave clock that can be observed on both PORTB bits PB0 and PB1. A square wave clock is defined as a clock that is a logic “1” for half of the clock period and a “0” for half of the clock period (50% duty cycle). You will need to create a delay loop to implement this design. Before creating code draw a flowchart for your design solutions. You can use either Bit Set and Bit Clear instructions on a user defined GPR for single bit or logical instructions like OR/ AND or XOR for multiple bits in the GPR to generate the clock.**

***Part A: MPLAB X IDE***

**Write an Assembly program using MPLAB X IDE and that will create a 100KHz square wave clock. Assume the Oscillator used on the 16F84A is 20 MHz making the instruction cycle 5 MHz. Output this clock from your GPR to two PORTB outputs, PB0 & PB1. Make PB0 the true clock and make PB1 the inverted clock; that is, when PB0 is a logic “1”, PB1 is a logic”0” and vice-versa. Save the program and do a build to obtain a .HEX object file for downloading to Proteus 8 in Part B of this Lab.**

1. **Use the Debugger with “Watch” windows to single step your code while observing “W” , PORTB and GPR registers you are using.**
2. **Use the “Stopwatch” window to verify your loop delays for the clock period; that is, how much time does the clock remain high and how much time to remain low. Record the delays in instruction cycles and microseconds and include both in your report.**
3. **For part B, Use the Digital Scope in Proteus and measure the clock period and duty cycle. Include these measurements in your report.**

***Part B: Proteus 8***

**Implement your design with Proteus 8. Connect output PB0 and PB1 to the Digital Oscilloscope.**

**Download the HEX file from the build in Part A and make sure the Oscillator is set to 20 MHz.**

**Lab Report & Demonstration:**

1. **Hand in the flowchart for your designs, part A**
2. **If applicable calculate and write down all expected results of the program prior to demonstration as requested above. (Ex. Delay calculation) and hand this in.**
3. **Show your delay loop calculations to get the specified delay to produce the 100KHz clock in part A.**
4. **Demonstrate to Instructor that program has no build errors and operates correctly using the MPLAB X Debugger/Stopwatch and then demonstrate the Proteus design implementation.**
5. **Hand in copies of Watch windows and the Proteus 8 Digital Oscilloscope trace and measured clock period and duty cycle on the scope.**
6. **Copy of .asm program and the Proteus schematic to hand in**