

## Embedded and Realtime Systems

**Laboratory 6**      **Name:** \_\_\_\_\_**INSTRUCTIONS**

**Before attempting this lab, be sure you are familiar with the tutorial Interrupts and Timer0 available on Moodle. This laboratory should be completed within the 3 hours allocated and submitted to Moodle as a single file. If you have multiple files, archive them together e.g. zip them into one file, before submitting. Be sure to include your names on all your work.**

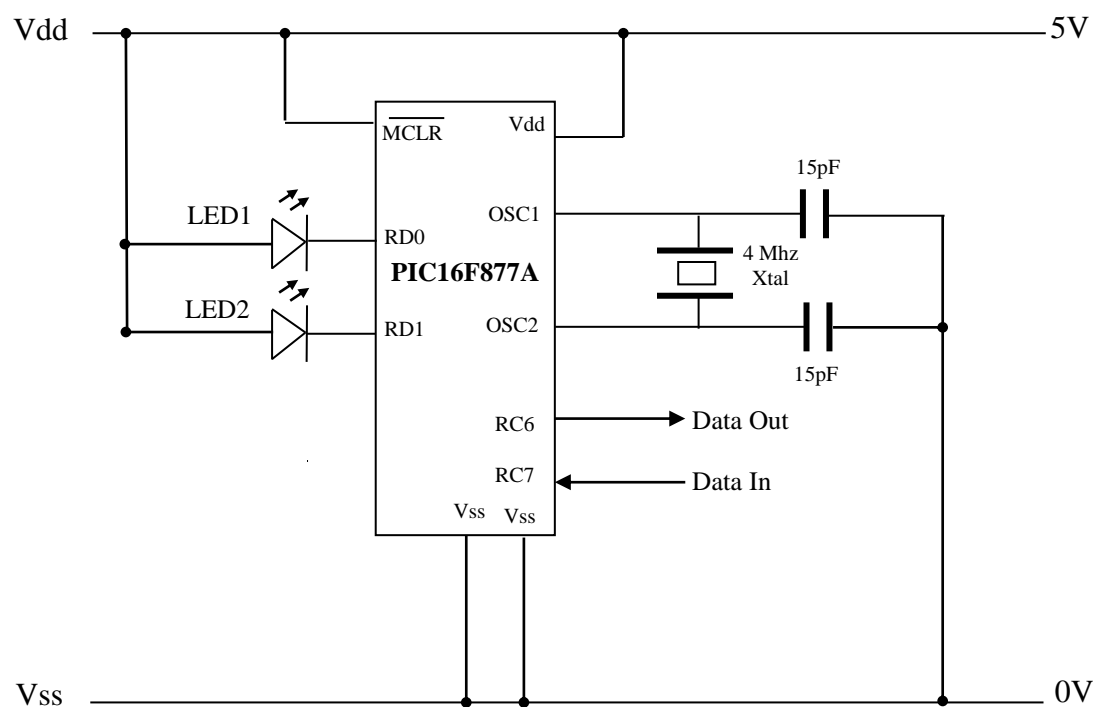
**This laboratory utilises Interrupts and Timers.**

**DETAILS**

Figure 1 below depicts a basic configuration of an embedded system based around the PIC16F877A.

The circuit consists of the following:

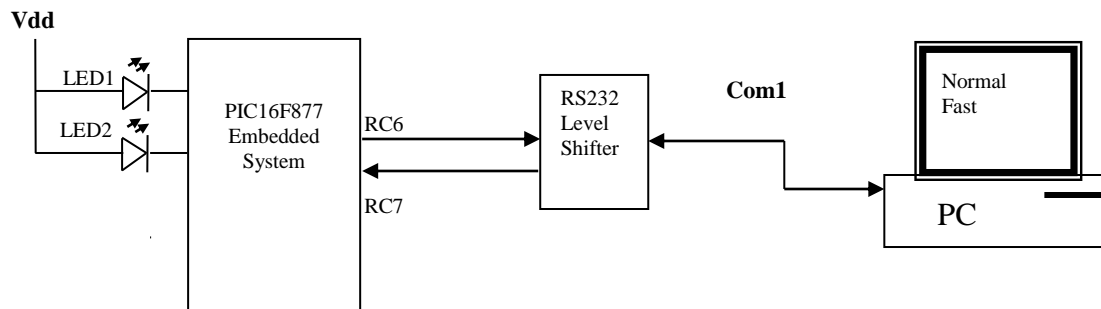
Fosc :	4 Mhz	
LED1 :	LED	RD0
LED2 :	LED	RD1
DataOut :	Serial Data Output.	RC6    Output (needs to be set as input)
DataIn :	Serial Data Input	RC7    Input



**Figure 1**

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Figure 2 below depicts a system overview of the embedded system and a bi-directional connection to a PC.



**Figure 2**

### Description on Assignment

Figure 1 is an embedded system. This embedded system is connected to a PC through COM1 asynchronous serial port (Figure 2).

The configuration for the asynchronous communication should be as follows:

1 Start Bit  
**9600 Baud Rate**  
 No Parity  
 8 Data Bits  
 1 Stop Bit

### PART 1

If  $F_{osc} = 20\text{Mhz}$ , what is the maximum interrupt period possible with Timer0?  
**(15 marks).**

### PART 2

Using the Timer1 interrupt, write a program that flashes LED1 at a rate of  $\sim 2\text{hz}$  and LED2 at a rate of  $\sim 4\text{hz}$ . The Superloop should contain no code.

- A lab demonstrator should verify the operation of your work **(45 marks).**

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**PART 3**

Continuing from part 2 above use the USART asynchronous receive interrupt to generate an interrupt when a character is received from Putty.

If the character 'N' is received:

LED1 flash rate is ~2hz

LED2 flash rate is ~1hz

Send "Normal Mode" once to Putty

If the character 'F' is received:

LED1 flash rate is ~4hz

LED2 flash rate is ~2hz

Send "Fast Mode" once to Putty

**NOTE:** Sending "Normal Mode" and "Fast Mode" text to Putty should be done in the Superloop and not in the Interrupt Service Routine.

**- A lab demonstrator should verify the operation of your work (40 marks).**

**Datasheet References:**

**Registers associated with the Timer1 module are given in Table 6.2**

**USART Receive interrupt details are in section 10.2.2**