UNIVERSIDAD DE GUANAJUATO

D. I. C. I. S.

Microprocessors and Microcontrollers Laboratory

Laboratory session 1:

Introduction to PIC18F45K50

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Introduction to PIC18F45K50

Objetive:

To implement a basic system for operating the PIC 18F45K50

To work with MPLAB IDE for editing, compiling and debugging code for microcontrollers from Microchip.

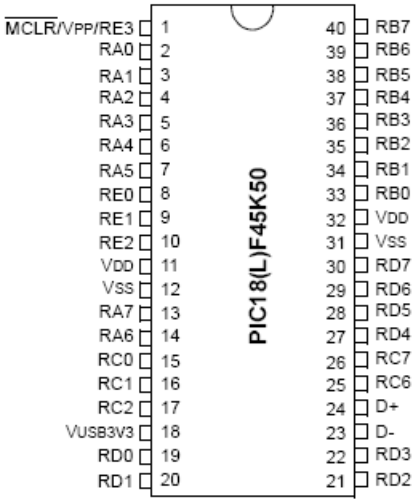
Resources:

1	Microcontroller PIC 18f45K50
8	LEDs
8	220Ω resistors
1	MPLAB IDE software
1	Laptop
1	PIC Programmer
1	PIC18F45K50 data sheet

2.1 Introduction.

Microcontrollers are used mainly in embedded systems in a wide variety of applications. In this lab session a microcontroller will make a LED flashing. The focus is to learn the process from writing code to program a microcontroller and use it on a proto-board to test it.

Pin diagram for PIC18F45K50:



40-pin diagram

For this and the following sessions it is mandatory to obtain a copy of the PIC18F45KA50 data sheet (printed or electronic) from www.microchip.com.

2.2 Procedure.

A. For editing, debugging and simulating code, in order to program the microcontroller, it will be used the graphical software MPLAB X IDE (Integrated Development Environment). After opening this program, select, from **File** in the menu, the option **New Project**. In the windows that will emerge, we choose the default options: "**Microchip Embedded**" and "**Standalone Project**". In the next window Family: **Advanced 8-bit MCUs (PIC18)**, and Device: **PIC18F45K50**. The following window is left with the default values. In the next window we select **mpasm** in order to compile using assembler code. In the next window we select the Project Name and the location where the project and all its files will be saved, and then we press the button **Finish**.

Once the new project is initiated, open a new window for writing code. This window should be saved with an .asm extension. The generated file has to be loaded in the project window under "Source Files". This can be done with the mouse right button applied over "Source Files".

The following code will be written in this new window and compiled.

```
; Programa contador de 4 bits con 'clear' y subrutina de retardo

 LIST P = 18f45K50
  #include<p18f45K50.inc>

  CONFIG WDTEN = OFF              ; Disables the Watchdog
  CONFIG MCLRE = ON          ; Enables MCLEAR
  CONFIG DEBUG = OFF         ; Disables Debug mode
  CONFIG LVP = OFF           ; Disables Low-Voltage programming
  CONFIG FOSC = INTOSCIO     ; Enables the internal oscillator

  org 0                      ; Sets first instruction in address 00

  Aux1          EQU 0x00     ; Reserves register 0
  Aux2          EQU 0x01     ; Reserves register 1

Start:
  MOVLB         0x0F
  CLRF          ANSELD,1
  CLRF          PORTD        ; Cleans PORT D
  CLRF          TRISD        ; Sets PORT D pins as outputs
  CLRF          Aux1         ; Cleans Aux1
  CLRF          Aux2         ; Cleans Aux2
  MOVLW         b'001100011‘ ; Configures OSCCON register
  MOVWF         OSCCON

MainLoop:
  BTG           PORTD,RD1    ;Toggles PORT D PIN 1 (20)
Delay1:
  DECFSZ        Aux1,1       ;Decrementa Aux1 en 1, salta siguiente instrucción si Aux1 es 0
  GOTO          Delay1
  DECFSZ        Aux2,1
  GOTO          Delay1
  GOTO          MainLoop
  end
```

Once the code is written and saved, one selects the option Build All in the menu.

When the program is compiled, the file with the same name as the .asm file but with .hex extension is used for programming the microcontroller. Ask for assistance in this step.

B. Once the PIC is programmed, it is placed in the proto-board and should be connected according to the following diagram. Be careful when handling the PIC because it can be damaged by static electricity. V_{DD} will be set at 5V and V_{SS} at 0V. Maximum current from each pin is 25 mA. If your LEDs cannot cope with this amount of current you should use a 220Ω resistor in series with the LED (as it is shown in the diagram).

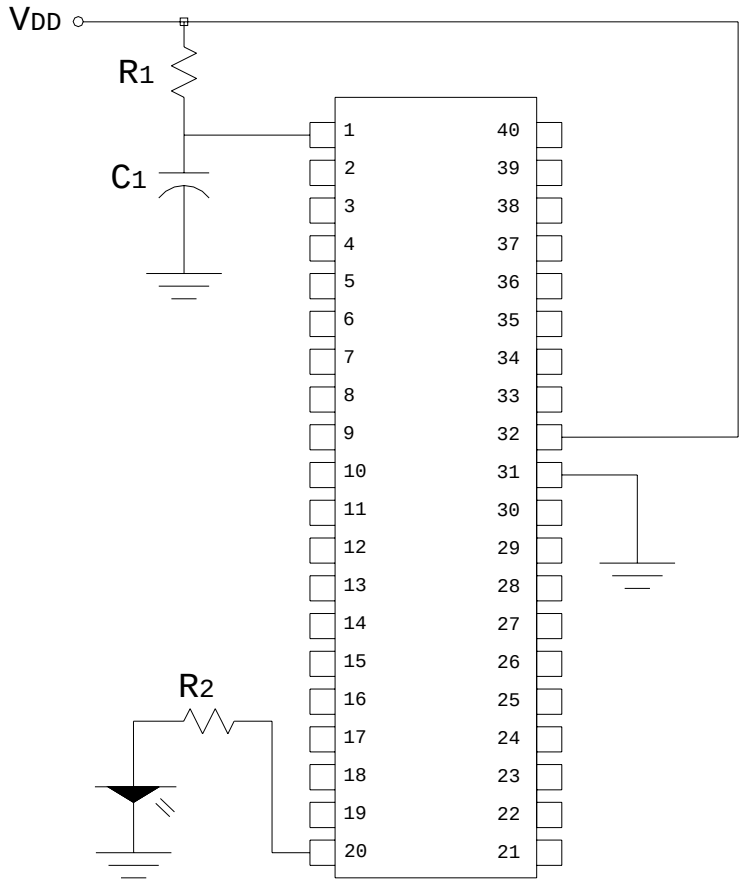


Table with the recommended values:

Símbolo	Valor Min	Valor Max
V_{DD}	5V	5V
R_1	1KΩ	-
R_2	-	220Ω
C_1	10μF	-

Resistor R1and capacitor C1 are recommended to avoid that voltages outside range restart the device or it having high consumption of energy. If you are using a regulated source, you can go without them.

2.3 Laboratory activities

1. Using the instruction set, modify the previous code in order to generate a falling count (FF, FE, FD,…, 01, 00, FF, FE…) as an output in PORTD. You should connect 8 LEDs to the PORT D pins. Show to the professor the code generated and the microcontroller working on the proto-board..

2. Report the default values from the PORTD, TRISD, and OSCCON registers (these values can be found in the data sheet).