University of Ruhuna

Bachelor of Science General Degree Level III (Semester II) Examination

March 2019

Subject: Physics
Course Unit: PHY3282

TWO HOURS

PART B – 01 hour & 15 minutes

Answer question No.1 and any 04 other questions only.

All symbols have their usual meaning

Use given data sheets to answer question

1. You are given a PIC16F84A microcontroller, common cathode type Seven Segment Display (SSD) and 3 push button type switches (SW1, SW2 and SW3) to construct an embedded system in order to control the SSD via above mentioned switchers and generate an uninterrupted 2 kHz square wave signal through RA0 simultaneously. Controlling procedure of the SSD is given below.

Switch	Action at the push event
SW1	Increases the current value of the SSD by 1
SW2	decreases the current value of the SSD by 1
SW3	set SSD value as 0

Value of the SSD must be ranged from 0 to 9. When present value of the SSD is 0 the next value after pushing the SW1 must be 9. When present value of the SSD is 9 the next value after pushing the SW2 must be 0. Answer the followings regarding this system [Hint: Use interrupt].

i Assign suitable input and output pins for hardware interfaces **[08 Marks]**

ii Draw the complete hardware diagram for the system including other essential components which are necessary to operate the system properly **[10 Marks]**

iii Draw appropriate flow charts for main and other sub routings (including the interrupt program) in order to operate the above system **[08 Marks]**

iv Write down a complete Assembly Language program to execute the above system **[10 Marks]**

2. Write down suitable macros in assembly language in order to operate the following functions using a PIC16F84A microcontroller.

i To switch Bank 1 **[04 Marks]**

ii To set a given pin of a given port as an input **[04 Marks]**

iii To add the contents of two registers and save the result in the W register **[04 Marks]**

iv To jump a particular label if clear a given bit of a given register **[04 Marks]**

3. Draw a suitable hardware diagram for interfacing each of the following devices with a microcontroller.

i A pull-up switch

ii An LED (assume the operating voltage is 1.8 V and current is 15 mA respectively)

iii 12 V, 12 W electric bulb

iv 12 V, 500 mA Relay **[16 Marks]**

4. Write a suitable program in assembly language in order to write 0X07 at the 0x05 address of the Electrically Erasable Programmable Read Only Memory (EEPROM) in a PIC16F84A microcontroller. [16 Marks]

5. Rewrite the following assembly program using the14-bit machine codes. [16 Marks]

```
#INCLUDE "P16F84A.INC"
        CBLOCK EQU 0X0D
COUNT1
COUNT2
        ENDC
 ORG 0X00
INIT            MOVLW       0X0F
MAIN            XORWF       PORTB, 0X00
                BTFSC       STATUS, 0X02
                CALL        DELAY
                GOTO        MAIN
  ORG 0X20
DELAY           DECFSZ      COUNT2,1
                GOTO        DELAY
                RETURN

        END
```

6. Write down an assembly language program in order to convert an analog voltage available on AN1 and output the relevant ADRESL value through PORTB continuously with the parameters given below.

Parameter	Value
Clock Conversion	Fosc/16
Results format	Right justified
Vref+	4 V
Vref-	0 V
Maximum number of analog channels	2

[16 Marks]

7. Write a suitable program in assembly language in order to send letter "H" from a PIC16F877A micro controller to a computer via an asynchronous serial communication under a 9600 bps baud rate. (Assume that the microcontroller is driven by a 20 MHz Crystal and BRGH=1) [16 Marks]