UTHM
Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2015/2016

COURSE NAME	:	MICROPROCESSOR AND MICROCONTROLLER
COURSE CODE	:	BEC 30403
PROGRAMME	:	BACHELOR OF ELECTRONIC ENGINEERING WITH HONOURS
EXAMINATION DATE	:	DECEMBER 2015 / JANUARY 2016
DURATION	:	2 HOURS 30 MINUTES
INSTRUCTION	:	ANSWER **ALL** QUESTIONS

THIS QUESTION PAPER CONSISTS OF **FIVE (5)** PAGES

Q1 (a) Differentiate between PIC16 and PIC24 microcontroller models.

(4 marks)

(b) List FOUR (4) components that are available in microcontrollers but not in microprocessors.

(4 marks)

(c) Differentiate Special Function Register (SFR) with General Function Register (GFR) using appropriate examples.

(4 marks)

(d) You have been asked to develop a TV remote controller application using PIC16F877A which has a total of 14 KB of program memory. Before writing the application program, estimate the maximum number of instructions you can have for the program.

(3 marks)

Q2 (a) Produce the outputs of the execution for the following instructions, assuming the starting content of working register is 0x0F and file register address 0x0D is 5A for each instruction with carry C=0 as the initial value:

(i) RLF 0D

(2 marks)

(ii) XORWF 0D

(2 marks)

(iii) SWAPF 0D

(2 marks)

(iv) INCFSZ 0D

(2 marks)

(b) Determine the number of execution clock cycles required to complete the instructions shown in **Figure Q2(b)**.

```
1              MOVLW 55H
2              MOVWF PORTB
3              CALL OFF
4              BSF PORTA, BIT3
5   OFF        BCF PORTA, BIT3
```

FIGURE Q2(b)

(4 marks)

(c)   Calculate the time to execute one instruction when the clock from crystal oscillator is 15 MHz.

(2 marks)

(d)   Calculate the total execution time for the instructions given in **Figure Q2(d)**. Assume the clock from crystal oscillator is 20 MHz and initial value for Bit 3 Port A is 0.

```
1            BSF TRISA, 3
2            BCF TRISB, 5
3    HERE    BTFSC PORTA, 3
4            GOTO HERE
5            BSF PORTB, 5
6            BCF PORTB, 5
7            END
```

FIGURE Q2(d)

(5 marks)

Q3   (a)   Produce related instructions in microcontroller assembly language to perform the following operations:

(i)   to configure Port RA0, RA1, RA2, RA3, RA5, RE0, RE1, and RE3 as analogue inputs.

(6 marks)

(ii)   to test Port RB0 and *goto* label "restart" if it is high.

(2 marks)

(b)   Differentiate between macro and subroutine in terms of memory location.

(5 marks)

(c)   Captured-Compare-Pulse (CCP) module in PIC16F877 has a 16 bits Pulse Width Modulation (PWM) duty cycle register. Formulas to calculate the PWM period and duty cycle are given as follows:

$$PWM \text{ period, } PR2 = [\tau_{PWM}/(4 \times \tau_{OSC} \times prescaler)] - 1$$
$$PWM \text{ duty cycle} = (PWM_{dc} \times \tau_{PWM}) / \tau_{OSC} \times prescaler$$

Based on the following requirements,

The DC motor is connected to the PIC using 8 MHz oscillation frequency and will generate a 10,000 Hz PWM frequency with 30% duty cycle and 4 prescaler.

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write the correct assembly program to set suitable values in the following registers:

    (i)   PR2

(4 marks)

    (ii)   CCPR1L

(2 marks)

    (iii)   CCP1CON

(6 marks)

    (iv)   T2CON

(2 marks)

Q4   (a)   Compare the addressing modes between PIC microcontroller and 8086 microprocessor.

(4 marks)

    (b)   List FOUR (4) control instructions in Intel 8086 processor.

(4 marks)

    (c)   State FOUR (4) types of flag and their function in Intel 8086 processor.

(4 marks)

Q5   (a)   Differentiate between logical address and physical address in the Intel 8086 processor.

(4 marks)

    (b)   The logical address of an instruction consists of Code Segment (CS) and Instruction Pointer (IP). If CS = 0x23AA and IP = 0x5C21, calculate:

        (i)   the logical address

(2 marks)

        (ii)   the offset address

(2 marks)

        (iii)   the physical address

(2 marks)

        (iv)   the lower range of the code segment

(2 marks)

        (v)   the upper range of code segment

(2 marks)

(c)   Assuming that SP = 0434, AX = F4C6 and DI = A053, determine the contents of the stack using appropriate diagrams, when each of the following instructions is executed in sequence:

        PUSH AX
        PUSH DI

(13 marks)

– END OF QUESTIONS –