



**UTHM**

Universiti Tun Hussein Onn Malaysia

**UNIVERSITI TUN HUSSEIN ONN  
MALAYSIA**

**FINAL EXAMINATION  
SEMESTER II  
SESSION 2016/2017**

COURSE NAME : MICROCONTROLLER  
COURSE CODE : DAE 32203 / DAR 21403  
PROGRAMME CODE : DAE / DAR  
EXAMINATION DATE : JUNE 2017  
DURATION : 2 HOURS 30 MINUTES  
INSTRUCTION : **PART A: ANSWER ALL  
QUESTIONS.  
PART B: CHOOSE THREE (3)  
QUESTIONS ONLY.**

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THIS QUESTION PAPER CONSISTS OF NINE (9) PAGES

## PART A

- Q1** (a) Microcontroller has mechanism called watchdog timer and hardware timer to support its operation.
- (i) Explain briefly the watchdog timer and how it works. (2 marks)
  - (ii) Compare the difference between watchdog timer and hardware timer. (2 marks)
- (b) The circuit in **Figure Q1(b)** operates by showing the counter value by rising up the number value beginning from 0 to 9 with time interval 2 second. Delay Timer PIC is from Hardware Timer (TMR0) with prescaler 1:128 and preload value TMR0 is set to 0. The PIC is provided with Oscillator frequency ( $F_{osc}$ ) 4 MHz.
- (i) Calculate the TMR0 overflow time of the system. (3 marks)
  - (ii) Determine the number of overflow must be declared in the interrupt function. (2 marks)
- (c) Explain each line of programming command listed below.
- (i) `#define TOCS OPTION_REG.F5`
  - (ii) `#define TOSE OPTION_REG.F4`
  - (iii) `#define GIE INTCON.F7`
  - (iv) `#define TMR0IE INTCON.F5`
  - (v) `#define TMR0IF INTCON.F2`
- (5 marks)
- (d) USB or the Universal Serial Bus Interface is now well established as an interface for computer communications. List **two (2)** advantages and **two (2)** disadvantages of USB. (4 marks)
- (e) The **Figure Q1(e)** is showed the unaccomplished circuit to build up the serial communication from PIC16F877A to a personal computer (PC) using RS232 connector.
- (i) Draw back the figure and illustrate **five (5)** suggested connections to complete the system. (5 marks)
  - (ii) State the main function of MAX232. (2 marks)

**PART B**

- Q2** (a) Draw a block diagram of a microcontroller. (6 marks)
- (b) Name the **three (3)** components of a Central Processor Unit (CPU). (3 marks)
- (c) Determine the function of following Special Function Register (SFR) for PIC16F877A:
- (i) TRISA (2 marks)
  - (ii) PORTB (2 marks)
  - (iii) ADCON1 (2 marks)
- (d) There are many microcontroller brands that developed recently in education sector. Express your general knowledge how the microcontroller can enhance our quality of daily life by specifying the brand of microcontroller and its application. (10 marks)

- Q3** (a) The following **Table Q3(a)** showed several assembly codes for PIC. Predict the right output of each code in related register after the instruction:

**Table Q3(a)**

No.	Instruction	Before Instruction	After Instruction
(i)	ADDWF PORTA,0	W = 0x17 PORTA = 0xC2	W = PORTA =
(ii)	ADDLW 0x15	W = 0x10	W =
(iii)	ANDWF PORTB,0	W = 0x17 PORTB = 0xC2	W = PORTB =
(iv)	ANDLW 0x5F	W = 0xA3	W =

\*Please show your method to get the answer.

(10 marks)

- (b) Based on the circuit **Figure Q3(b)**, write a running light application using MikroC language based on the condition below:

When button SW1 is pressed LED will light from D1 to D8 and when the SW2 is pressed LED will light from D8 to D1, while in standby mode all LED lights. During running light, only **one (1)** LED is ON in one time. Use 0.5 second delay for each LED to switch ON and OFF.

(15 marks)

- Q4** (a) State the function of the following register:

- (i) Analog/Digital Control Register 0
- (ii) ADRESH and ADRESL

(4 marks)

- (b) Based on the **Programming Q4(b)**, determine the specific port or pin in realizing the system workflow:

```
while(1) {
    temp_res = Adc_Read(3);
    PORTB = temp_res;
    PORTD = temp_res >> 2;
}
```

**Programming Q4(b)**

- (i) Input pin
- (ii) Output bit 5 and bit 2
- (iii) Output bit 9 and bit 10

(6 marks)

- (c) **Figure Q4(b)** shows a circuit diagram of converting analog input on channel 1 to 8-bit digital number with voltage reference (Vref-) 0V and high voltage reference (Vref+) 5V.

- (i) Calculate the resolution step.

(2 marks)

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- (ii) What makes every LED to turn ON?

(3 marks)

- (iii) Write a C program that make the LED response upon the variability of the input resistance (RV).

(10 marks)

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**Q5** Write a C program for temperature application on PIC16F877A based system as shown in **Figure Q5**. The system should show the current temperature value in degree Celsius on the LCD and two LEDs should active based on the table below:

	<b>LED D1</b>	<b>LED D2</b>	<b>Alarm</b>
<b>Above 50° C</b>	ON	OFF	ON
<b>Below 50° C</b>	OFF	ON	OFF

(25 marks)

**Q6** (a) How to interface DC motor with microcontroller (2 marks)

(b) From the answer above (Q6a), describe the functions of mentioned component, while the interface between a DC motor with microcontroller. (2 marks)

(c) Draw a circuit that shows the interfacing between PIC16877A with a DC motor. (10 marks)

(d) **Programming Q6(d)** shows a C code of a task in controlling the speed of DC motor in PIC16F877A chip. Analyze the working process and identify the following components:

(i) The connected port for switch 1 to increase the motor speed. (2 marks)

(ii) The connected port for switch 2 to slow down the motor speed. (2 marks)

(iii) The initial frequency of PWM. (1 marks)

(iv) The present duty cycle when switch 1 is pressed 3 times. (3 marks)

(v) The present duty cycle when switch 2 is pressed 2 times after switch 1 is pressed 4 times. (3 marks)



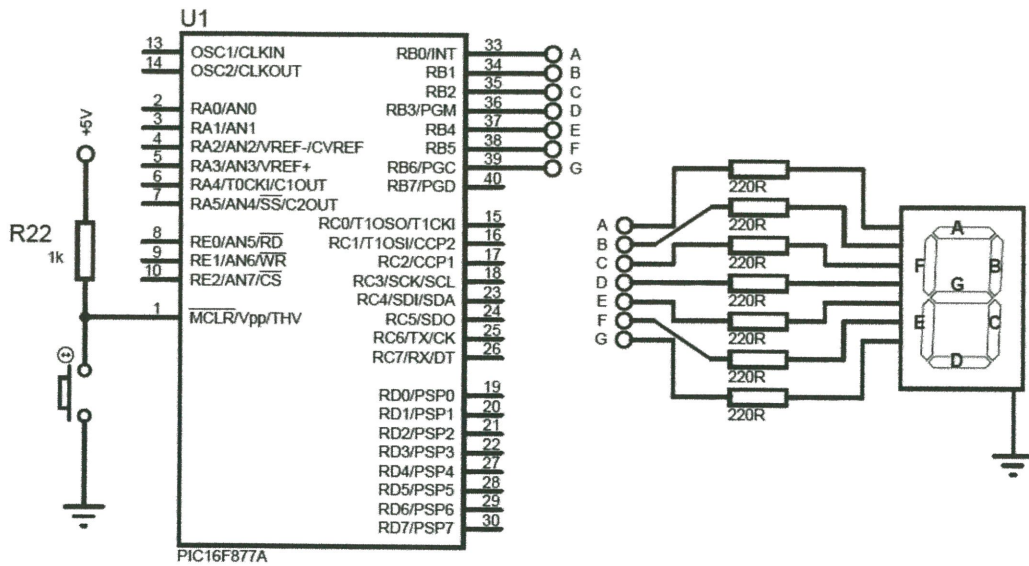
```
void main()
{
    short duty = 0;
    TRISD = 0xFF;
    TRISC = 0x00;
    TRISB = 0x00;
    PORTB = 0x02;
    PWM1_Init(1000);
    PWM1_Start();
    PWM1_Set_Duty(duty);
    while (1)
    {
        if (!PORTD.F0 && duty < 250) {
            Delay_ms(40);
            duty = duty + 10;
            PWM1_Set_Duty(duty);
        }
        if (!PORTD.F1 && duty > 0) {
            Delay_ms(40);
            duty = duty - 10;
            PWM1_Set_Duty(duty);
        }
        Delay_ms(10);
    }
}
```

**Programming Q6(d)****TERBUKA****-END OF QUESTION-**

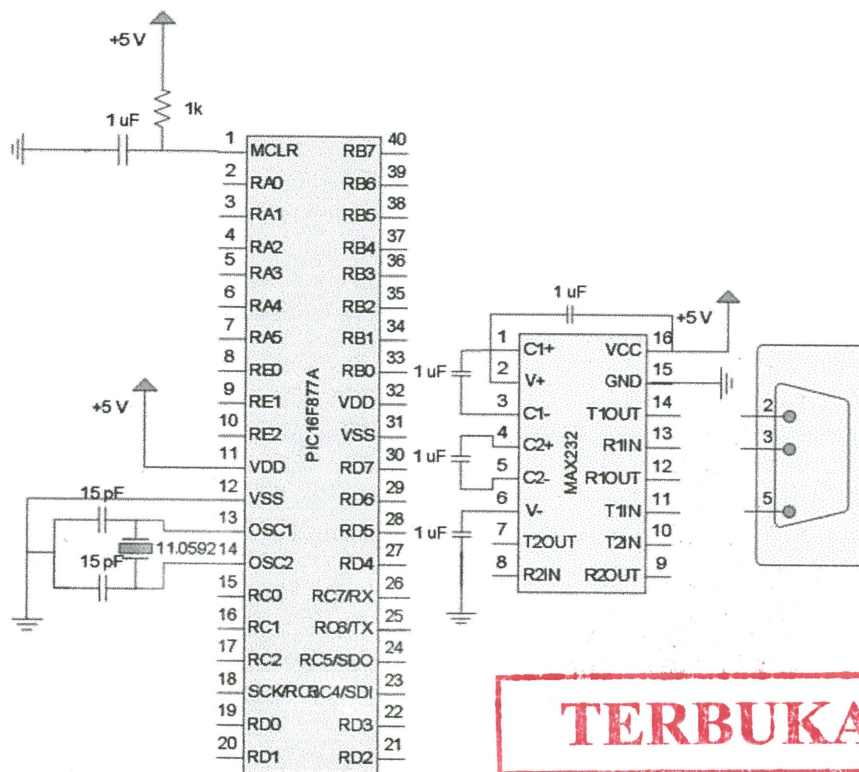
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**FIGURE Q1(b)**



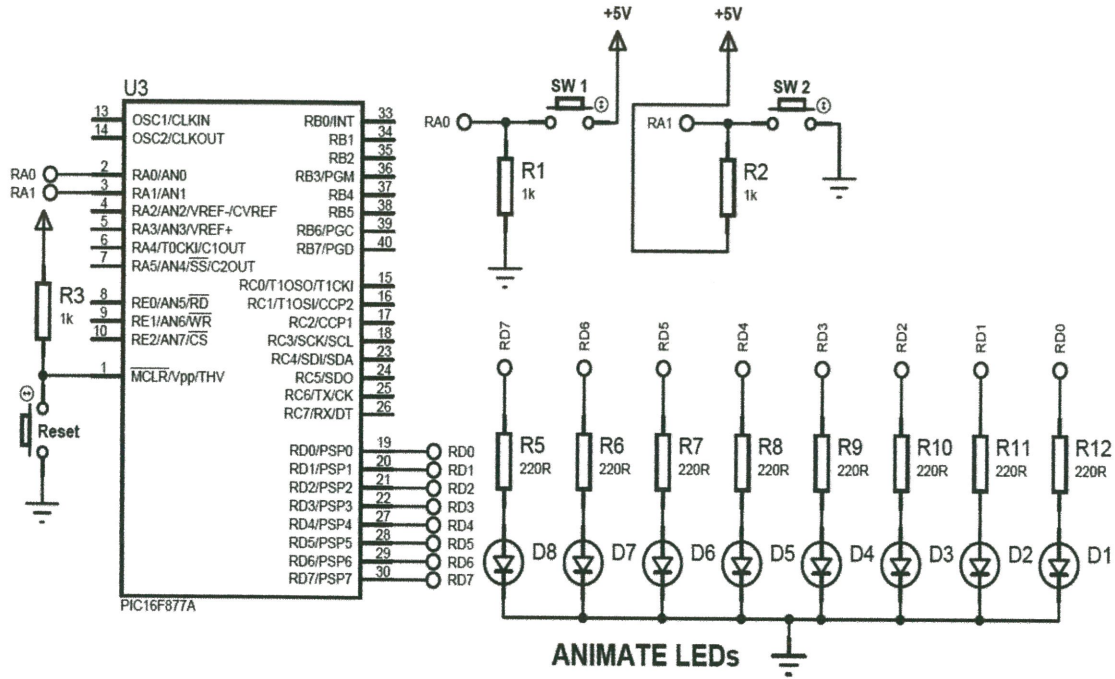
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**FIGURE Q1(e)**

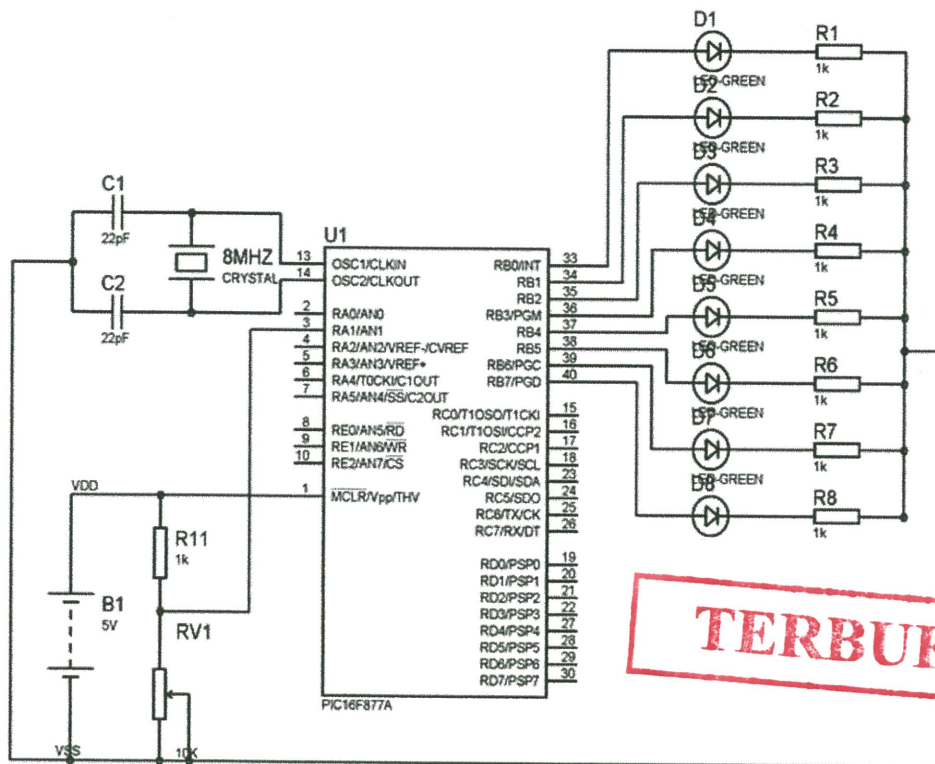
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**FIGURE Q3(b)**



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**FIGURE Q4(b)**



