UTHM
Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER 1
SESSION 2022/2023

COURSE NAME : MICROCONTROLLER

COURSE CODE : DAE 32203

PROGRAMME CODE : DAE

EXAMINATION DATE : FEBRUARY 2023

DURATION : 2 HOURS 30 MINUTES

INSTRUCTION :
1. ANSWER **THREE (3)** QUESTIONS ONLY IN SECTION A AND **ALL** QUESTION IN SECTION B.

2. THIS FINAL EXAMINATION IS CONDUCTED VIA **CLOSED BOOK.**

3. STUDENTS ARE **PROHIBITED** TO CONSULT THEIR OWN MATERIAL OR ANY EXTERNAL RESOURCES DURING THE EXAMINATION CONDUCTED VIA CLOSED BOOK

THIS QUESTION PAPER CONSISTS OF **EIGHT (8)** PAGES

TERBUKA

SECTION A

Q1   (a)   Microcontroller technology is currently used widely in many applications such as in industry, medical, robotics and others.

            (i)   Give the definition of microcontroller.

                                                                (2 marks)

            (ii)   List **five (5)** elements in microcontroller.

                                                                (5 marks)

      (b)   System bus is a collection of wires carrying information within a computer system. Briefly explain the **three (3)** types of busses.

                                                                (6 marks)

      (c)   Serial Communication Protocol (SCP) is a communication protocol and exchanging of data between two microcontrollers in the form of bits.

            (i)   List out **three (3)** types of SCP that are used in Arduino UNO.

                                                                (3 marks)

            (ii)   Differentiate the types of SCP as in Q1(c)(i) in terms of complexity, speed and number of devices.

                                                                (9 marks)

Q2 (a) Refer **Table Q2(a)**, the initial state of all the LEDs is OFF and the LEDs sequence is between 1 to 4 seconds. LED1 to LED3 is connected into pin 11 until pin 13.

(i) Explain the benefit of using the timer function instead of delay in the Arduino application.

(2 marks)

(ii) Using FOR loop, declare all the LEDs as INPUT.

(3 marks)

(iii) Create a function called blink() that able to change the state of LEDs as in **Table Q2(a)**.

(2 marks)

(iv) Without using delay() function and apply function in **Q2(a)(iii)**, create code for **Table Q2(a)**. Assume the variable current time and previous time have been declared in the program.

(5 marks)

(b) Based on **Figure Q2(b),** answer the following:

(i) List **two (2)** conditions that must be TRUE before the interrupt can be executed.

(2 marks)

(ii) Given syntax below:
        attachInterrupt(interrupt pin, ISR function, mode);

Define interrupt pin, ISR function and, mode.

(3 marks)

(iii) Fill in **(a)** and **(b)** in **Figure Q2(b).**

(2 marks)

(iv) Complete the output of the code into **Table Q2(b).**

(6 marks)

Q3 (a) LCD is an electronically modulated optical device that uses the light-modulating properties of liquid crystals. LCDs are used in a wide range of applications.

   (i) Briefly describe the function of LCD.

   (1 mark)

   (ii) Give an example of LCD application in daily life.

   (2 marks)

(b) All of the LCD programming code uses the LiquidCrystal library that comes pre-installed with the Arduino IDE.

   (i) Briefly explain the meaning of the following codes:

```
#include <iquidCrystal_I2C.h>

LiquidCrystal_I2C lcd(0x27,20,4);

void setup() {
  lcd.begin(16, 2);
}
```

   (3 marks)

   (ii) Write a program to display an analog value on LCD.

   (4 marks)

   (iii) Write a program to blink and no blink the cursor.

   (7 marks)

(c) One of the application of LCD is displaying the temperature by interfacing the Arduino and LM35. Draw a circuit diagram to build a complete connection of Arduino and LM35 temperature sensor with a LCD display. You can refer **Figure Q3(c)** for Arduino UNO pin and LCD pin labels.

   (8 marks)

TERBUKA

Q4 (a) Microcontroller can controlled electric motor using Pulse Width Modulation (PWM), either to control speed or direction.

   (i) Define PWM.

   (2 marks)

   (ii) How many pins that the ATMEGA 328P can support PWM signals?

   (1 mark)

   (ii) Give **three (3)** types of motor that can be controlled using PWM.

   (3 marks)

   (iii) Sketch **three (3)** complete cycle of PWM with 70% duty cycle of a 5V input.

   (3 marks)

   (v) Write the single instruction of Arduino to generate 50% duty cycle of PWM signal at pin number 6?

   (1 mark)

   (b) (i) Based on **Figure Q4(d)**, what is the function of L239D?

   (1 mark)

   (ii) Based on the **Figure Q4(d)**, write a full programming code which is Button 1 (BTN1) will rotate the motor clockwise and Button 2 (BTN2) anticlockwise.

   (14 marks)

TERBUKA

SECTION B

Q5   Design a ptototype of an Automatic Brightness Lightning system to control the brightness of a lamp (i.e. use an LED) in three condition of darkness. Use a Light Dependant Resistor (LDR) to measure the darkness on the environment. The requirements are as follow:

1.   If the ADC value of the LDR is more than 700, turn OFF the LED.
2.   If the ADC value of the LDR is between 700 to 400, turn ON the LED with 50% brightness.
3.   If the ADC value of the LDR is less than 400, turn ON the LED with 100% brightness.

By referring to the above requirements,

(a)   Illustrate your proposed system circuit diagram.

(10 marks)

(b)   Develop a program based on the operation stated.
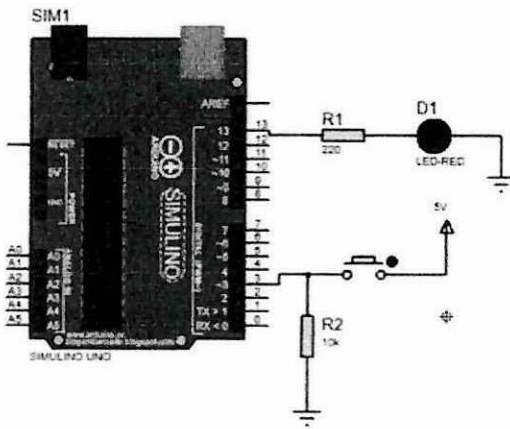
(15 marks)

- END OF QUESTION -

TERBUKA

Table Q2(a)

Time Sequence	LED1	LED2	LED3
0 – 1 seconds	ledStatus	ledStatus	ledStatus
1 – 2 seconds	!ledStatus	ledStatus	!ledStatus
2 – 4 seconds	ledStatus	!ledStatus	ledStatus


```
1    const int led = 13;
2    const int pushBtn = 2;
3    int state = LOW;
4
5    void setup()
6    {
7      pinMode(led, OUTPUT);
8      attachInterrupt((a),(b),(c));
9    }
10
11   void loop()
12   {
13     digitalWrite(led,state);
14   }
15
16   void ledBlinking(){
17     state = !state;
18   }
19
```

Figure Q2(b)

Table Q2(b)

Trigger Mode	Press	Hold	Release
CHANGE			
RISING			
FALLING			
LOW			

7

FINAL EXAMINATION

SEMESTER/SESSION: SEM 1/2022/2023　　　PROGRAMME CODE: DAE
COURSE NAME　　　: MICROCONTROLLER　　COURSE CODE: DAE 32203

Figure Q3(c)

Figure Q4(d)

TERBUKA