UNIVERSITI TEKNOLOGI PETRONAS

FINAL EXAMINATION
MAY 2024 SEMESTER

COURSE	:	**TEB2053 - EMBEDDED SYSTEM**
DATE	:	**12 AUGUST 2024 (MONDAY)**
TIME	:	**9:00 AM - 12:00 NOON (3 HOURS)**

INSTRUCTIONS TO CANDIDATES

1. Answer **ALL** questions in the Answer Booklet.
2. Begin **EACH** answer on a new page in the Answer Booklet.
3. Indicate clearly answers that are cancelled, if any.
4. Where applicable, show clearly steps taken in arriving at the solutions and indicate **ALL** assumptions, if any.
5. **DO NOT** open this Question Booklet until instructed.

Note :

i. There are **SIX (6)** pages in this Question Booklet including the cover page

ii. **DOUBLE-SIDED** Question Booklet.

1. a. Define the main purpose of the embedded systems.

[2 marks]

b. List **FOUR (4)** advantages and **FOUR (4)** disadvantages of embedded systems.

[8 marks]

c. Summarize the **FIVE (5)** types of IoT platforms.

[5 marks]

d. Explain the **FIVE (5)** major differences between the Raspberry Pi3 Model B and the Arduino Uno board.

[5 marks]

2 a. Identify **FIVE (5)** Arduino primitive data types.

[5 marks]

b. Analyze in detail the code shown in **FIGURE Q2b**.

[7 marks]

```
int LEDpin = 5;
int switchPin = 13;

bool running = false;

void setup() {
  pinMode(LEDpin, OUTPUT);
  pinMode(switchPin, INPUT);
  digitalWrite(switchPin, HIGH);
}

void loop() {
  if (digitalRead(switchPin) == LOW) {

    delay(100);
    running = !running;
    digitalWrite(LEDpin, running);
  }
}
```

FIGURE Q2b

c. Identify the syntax errors in the code displayed in **FIGURE Q2c**.

[5 marks]

```
1  void setup()
2    Serial.begin(9600)
3  }
4  void loop()
5    int sensorValue = analogRead(A0)
6      float voltage = sensorValue * (5.0 / 1023.0);
7      Serial.println(voltage)
8  }
```

FIGURE Q2c

d. Explain with an example the main purpose of the `constrain ()` function.

[3 marks]

3 a. List **FOUR (4)** types of Finite State Machine (FSM).

[4 marks]

b. Discuss how a Finite State Machine (FSM) works in detail.

[6 marks]

c. Identify the **FIVE (5)** layers in a standard IoT architecture model.

[5 marks]

d. Explain the main advantage of the Arduino MKR1000 board.

[5 marks]

4. a. List **SIX (6)** of the IoT protocols.

[6 marks]

b. Identify **FIVE (5)** of the commonly used measurement sensors in IoT.

[5 marks]

c. Discuss the difference between the Low-Energy Bluetooth and WiFi-Direct IoT networks technology.

[4 marks]

d. Explain in detail the purpose of having IoT security.

[5 marks]

5. a. Develop a C/C++ program using the `constrain ()` function to control the limit of the sensor values between 50 and 100.

[8 marks]

b. Compare the difference between Bit-shift left and Bit-shift right operations.

[2 marks]

c. Identify **TWO (2)** data processing operation functions that can be implemented in the Arduino development board.

[2 marks]

d. Explain the main purpose of the ATmega328 controller in the Arduino board.

[4 marks]

e. Discuss **TWO (2)** solutions to overcome the lack of common security standards in the context of the IoT environment.

[4 marks]

– END OF PAPER –