

CET3063 Internet of Things
Final Exam Answer Script
January 2022
Set A

Section A (50 marks)

- 1) Describe about a sound sensor. (6 marks)

It is a module that senses for sound, measured in unit deciBel.
 It detects the sinusoidal waves generated by a sound.
 Commonly, it has three pins; 5V power, output data, and ground pins.
 The best sound sensor application is the microphone.
2 marks will be awarded for each valid statement above, up to three only.

- 2) Name and discuss four layers of the Internet of things (IoT) system. (12 marks)

Layer	Discussion
Perception or physical layer (1 mark)	This layer is responsible to perform data collection and correspond to the actual work that run a specific task in a simulation. Example devices, such as controllers, sensors, switches, actuators, display, etc.. (2 marks)
Network (1 mark)	It is a communication layer that connects the physical devices together, either via wired or wireless technology. Internet is the core component for scalability in network coverage. (2 marks)
Platform (1 mark)	It creates the bridges that connect two devices from two different local area networks (LANs). For example, message queue telemetry transport (MQTT) service is a cloud platform which supports publish and subscribe operations. (2 marks)
Application (1 mark)	Data are accumulating at this layer for over certain period of time, which forms the Big data. Data analytics could be performed on Big data mainly for monitoring, mining, automation, optimization, and predictions. (2 marks)

- 3) Given a bit stream data, 0001011, show the data representations which are to be written from Arduino UNO to NodeMCU using the following interfaces.

- (a) UART (4 marks)

Start bit	Data packet	Parity	Stop bit	
0	0001011	0	1	(4 marks)

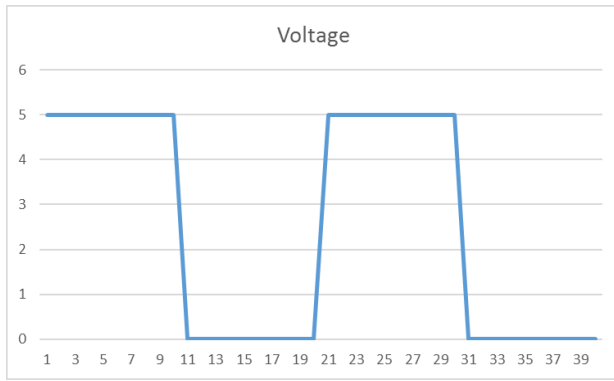
- (b) I²C (5 marks)

SCL	1					
SDA	Start bits	Data packet	RW	ACK	Stop bits	
	10	0001011	1 0	1	01	(5 marks)

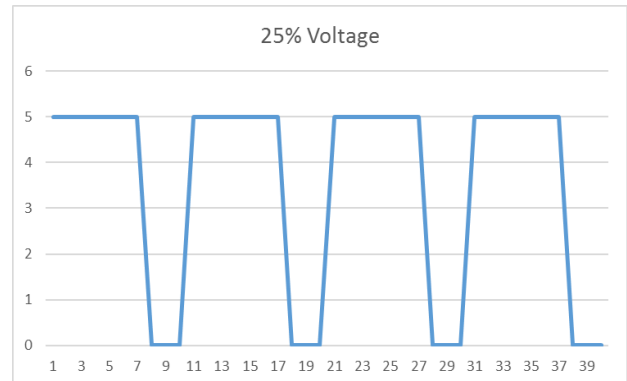
- 4) Compute the duty cycle, D given that a digital output value is 64 in an 8-bits microcontroller unit (MCU). Then, draw two graphs to show the output signal of pulse-width modulation (PWM) that run at 100% and the computed duty cycles, D running at ten milliseconds period. (8 marks)

Duty cycle, $D = \text{digital value} / \text{bit depth} \times 100$ **(2 marks)**

Duty cycle, $D = 64 / 255 \times 100$ **(1 mark)**
 $= 25.10\%$ **(1 mark)**



(a)



(b)

Figure 1: Graph representation for duty cycles. (a) Output voltage running at 100% duty cycle. (2 marks) (b) Output voltage running at 25% duty cycle. (2 marks)

5) Identify and discuss five service components involved for a medical center IoT system.

(15 marks)

Components	Discussion on the services
Information center	It allows customers to make queries and also registers patients for hospitalization.
Radiology and chemical lab	It collects samples from patients to generate the clinical reports for doctor's reference.
Clinic	Doctor reviews the clinical report and run further diagnose if necessary, to verify the symptoms and abnormality on a patient.
Hospital ward	This is the place where patients are accommodated. There are a few sections in the ward, such as general ward, standard room, intensive care unit (ICU), and critical care unit (CCU).
Operating theater	Surgical operations are performed in this place. It is a restricted area, whereby only surgeons, related medical staff, and patients who undergo surgery are allowed to enter.
Pharmacy	Medicines are stored in the department, which allows physician to manage and distribute the medicines to the patients.

1 mark will be awarded for each correct component above, up to five only.

2 marks will be awarded for each valid discussion on the corresponding service, up to five only.

Section B (50 marks)

- 1) Draw a circuit diagram that assembles the connections between a humidity sensor, a microcontroller unit, and a light-emitting diode (LED). (8 marks)

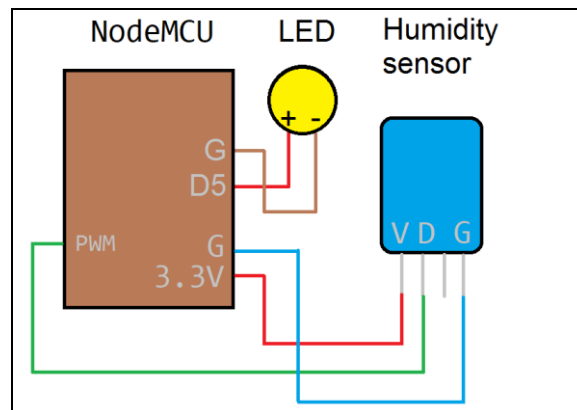


Figure 2: Circuit diagram

1 mark will be awarded for each correct connection and label, five in total.

1 mark will be awarded for each drawing of the components and labels, three in total.

- 2) Write a HTTP response to set a cookie to store the following information in Table 1. Then, set the availability of the above cookie information to expire on 2nd May 2022 at 5:30am. (7 marks)

Table 1: Cookie information

Key	Value
AUTHORIZE	YES
SESSION_ID	8X9Y0Z
LED_STATE	OFF

Set-Cookie: (1 mark)

AUTHORIZE=YES; (1 mark)

SESSION_ID=8X9Y0Z; (1 mark)

LED_STATE=OFF; (1 mark)

expires=Mon, 1 May 2022 21:30:00 GMT. (3 marks)

- 3) Format the JavaScript object notation (JSON) object below into Arduino code, before printing the content of this object into the serial monitor. (7 marks)

```
weather = {
  "country": "MY",
  "stationName": "Butterworth, Penang",
  "date": "22nd February 2022",
  "time": "1500",
  "temperature": {
    "Celsius": 33,
    "Fahrenheit": 91.4,
  },
  "humidity": 60
};
```

const char* country = doc["weather"]["country"] (1 mark)

const char* station = doc["weather"]["stationName"] (1 mark)

const char* date = doc["weather"]["date"] (1 mark)

const char* time = doc["weather"]["time"] (1 mark)

float tc = doc["weather"]["temperature"]["Celsius"] (1 mark)

```
float tf = doc["weather"]["temperature"]["Fahrenheit"] (1 mark)
float h = doc["weather"]["humidity"] (1 mark)
```

- 4) Write a code segment in Arduino Sketch to check the availability of the accelerometer. (7 marks)

```
int status; (1 mark)
status = module.begin(); (1 mark)
if(status < 0){ (1 mark)
    Serial.println("Module not found."); (1 mark)
    Serial.print("Status: "); Serial.println(status); (2 marks)
    while(1){} (1 mark)
}
```

- 5) Fill in the blanks for the wireless fidelity (Wi-Fi) configuration of ESP8266 chipset below. (5 marks)

```
#include <ESP8266WiFi.h> (1 mark)
IPAddress staticIP(192, 168, 127, 50); (1 mark)
IPAddress gateway(192, 1, 1, 1); (1 mark)
IPAddress subnet(255, 0, 0, 0); (1 mark)
IPAddress dns(1, 1, 1, 1); (1 mark)
```

- 6) Write a function in Arduino code to connect a MCU to a wireless local area network with a set of SSID and password. Then, display the device IP via serial monitor. (16 marks)

```
const char* ssid = "Peter"; (2 marks)
const char* password = "secretKey"; (2 marks)

void connectWLAN(){ (1 mark)
    WiFi.begin(ssid, password); (2 mark)
    while (WiFi.status() != WL_CONNECTED) { (2 marks)
        delay(500); (1 mark)
        Serial.print("."); (1 mark)
    }
    Serial.println(""); (1 mark)
    Serial.println("WiFi connected"); (1 mark)
    Serial.println("IP address: "); (1 mark)
    Serial.println(WiFi.localIP()); (2 marks)
}
```
