



AMERICAN INTERNATIONAL UNIVERSITY – BANGLADESH (AIUB)

Faculty of Engineering

Department of Electrical and Electronic Engineering

Course/Lab Name: EEE4103 Microprocessor and Embedded Systems

Semester: Spring 2023-24

Term: Mid

Quiz: 03M

Total Marks: 10

Time: 20 Minutes

Question Mapping with Course Outcomes:

Item	COs	POIs	K	P	A	Marks	Obtained Marks
Q1-2	CO1	P.a.4.C.3	K4			2×5	
Total:						10	

Student Information:

Student Name:	Solve Sheet	Section:	B
Student ID #:	Solve Sheet	Date:	04.03.2024
		Department:	

1. Compute the total time for which the device is in low-power mode as per the following program if the loop [5]
continues for 20 cycles.

```
#include "ArduinoLowPower.h"

void setup() {
  pinMode(LED_BUILTIN, OUTPUT); }

void loop() {
  digitalWrite(LED_BUILTIN, HIGH);
  delay(1000);
  digitalWrite(LED_BUILTIN, LOW);
  delay(1000);
  LowPower.deepSleep(8000); }
```

Answer:

If the above program is run then the time for which the device is in low-power deep sleep mode is 8000 ms or 8 s. Hence, if the loop continues for 20 cycles, then the device is in low-power deep sleep mode for $8 \times 20 = 160$ s.

2. Compute the duration that the Arduino blinks an LED connected to pin 10 and makes the power [5]
down the system. When powered down, the Arduino's current drops from 10 mA down to just 8 μ A. If the Arduino's supply voltage is 3.3 V then compute the amount of power that is saved by the Arduino during this power down mode.

```
#include "LowPower.h"

void setup() {
  pinMode(10, OUTPUT); }

void loop() {
  digitalWrite(10, HIGH);
  delay(1000);
  digitalWrite(10, LOW);
  LowPower.powerDown(SLEEP_4S, ADC_OFF, BOD_OFF, SPI_OFF, TWI_OFF);
}
```

Answer:

If the above program is run then the time for which the LED is ON is 1000 ms or 1 s because the `digitalWrite()` function sends a 'HIGH' signal to pin 10 where an LED is connected and then the `delay()` function makes a delay of 1000 ms. After that, the `digitalWrite()` function sends a 'LOW' signal to pin 10. After that, there is no `delay()` function, but the device goes into power-down mode for 4 s. As such, the duration that the Arduino blinks an LED connected to pin 10 is every 5 s, that is, the LED is ON for 1 s and OFF for 4 s, and this loop continues.

Initially, when the power is not down then the device draws a 10 mA current. Hence, it consumes a power of $3.3 \times 10 = 33 \text{ mW}$.

When the device is in low-power power-down mode then the device draws an 8 μA current. Hence, it consumes a power of $3.3 \times 8 = 26.4 \text{ } \mu\text{W} = 0.0264 \text{ mW}$.

So, the amount of power that is saved by the Arduino during the low-power power-down mode = $33 - 0.0264 = 32.9736 \text{ mW}$.