AMERICAN INTERNATIONAL UNIVERSITY – BANGLADESH (AIUB)
Faculty of Engineering
Department of Electrical and Electronic Engineering

Course/Lab Name: EEE4103 Microprocessor and Embedded Systems

Semester: Fall 2023-23 **Term**: Final **Quiz**: 01F **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:	22.11.2023	Department:	

1. Find the baud rate for the asynchronous normal operating mode when the oscillator frequency, f_{OSC} = 16 MHz, and register data is, *UBRRn* = 010100101010. Calculate the baud error and comment on whether there will be any communication error or not. Standard Baud rates are: 300, 600, 1200, 2400, 4800, 9600, 14400,19200, 38400, 57600, 115200, 230400, ... bps. [5]

Answer:

UBRRn = 010100101010 = $0\times2^{11}+1\times2^{10}+0\times2^{9}+1\times2^{8}+0\times2^{7}+0\times2^{6}+1\times2^{5}+0\times2^{4}+1\times2^{3}+0\times2^{2}+1\times2^{1}+0\times2^{0}$
= 1024+256+32+8+2 = 1322

For the asynchronous normal operating mode, $Baud\ Rate = \frac{f_{osc}}{16(UBRRn+1)} = \frac{16\times10^6}{16(1322+1)} = 756$ bps

Baud Error Rate, $\varepsilon = \frac{Standard\ baud\ rate - calculated\ baud\ rate}{Standard\ baud\ rate} \times 100\% = \frac{600-756}{600} \times 100\% = 26\%$

This value is >> 2%, therefore, there will be communication errors.

2. For the following program, determine the output if the shutter was opened for 10 ms: [5]

```
volatile boolean started;
volatile unsigned long startTime;
volatile unsigned long endTime;

// interrupt service routine
void shutter () {
  if (started)
endTime = micros ();
else
    startTime = micros ();
started = !started; } // end of the shutter
void setup () {
  Serial.begin (115200);
  Serial.println ("Shutter test ...");
  attachInterrupt (digitalPinToInterrupt (2), shutter, CHANGE);
}  // end of the setup

void loop () {
  if (endTime) {
    Serial.print ("Shutter open for ");
    Serial.print (endTime - startTime);
    Serial.println (" microseconds.");
    endTime = 0;   }  // end of if statement
} // end of the loop
```

Answer:

```
Shutter test ...
Shutter open for 10000 microseconds.
```