Date of Examination: 27/10/21

AHSANULLAH UNIVERSITY OF SCIENCE AND TECHNOLOGY
Department/School: Computer Science and Engineering
Program: B.Sc. in Computer Science and Engineering
Semester Final Examination: Fall 2020
Year: 3rd Semester: 2nd
Course Number: CSE3215
Course Name: Microcontroller Based System Design

Time: 02(Two) Hours **Full Marks: 50**

Use single answer script

Instructions:	i)	Answer script should be hand written and should be written in A4 white paper. You must submit the hard copy of this answer script to the Department when the university reopens.
	ii)	You must write the following information at the top page of each answer script: **Department:** **Program:** **Course no:** **Course Title:** **Examination:** **Semester (Session):** **Student ID:** **Signature and Date:**
	iii)	Write down Student ID, Course number and put your signature on top of every single page of the answer script.
	iv)	Write down page number at the bottom of every page of the answer script.
	v)	Upload the scan copy of your answer script in PDF format through provided **google form** at the respective course site (i.e., **google classroom)** using institutional email within the allocated time. Uploading clear and readable scan copy (uncorrupted) is your responsibility and must cover the full page of your answer script. However, for clear and readable scan copy of the answer script student should use only one side of a page for answering the questions.
	vi)	You must avoid **plagiarism,** maintain **academic integrity, and ethics**. You are not allowed to take any help from another individual and if taken so can result in stern disciplinary actions from the university authority.
	vii)	Marks allotted are indicated in the **right margin.**
	viii)	Necessary **charts/tables** are attached at the end of the question paper. You may use graph papers where necessary.
	ix)	Assume any reasonable data if needed.
	x)	Symbols and characters have their usual meaning.
	xi)	Before uploading rename the PDF file as **CourseNo_StudentID.pdf** For example, CSE3215_150204004.pdf
	xii	The answer script **(one single pdf file)** must be uploaded at designated location in the provided **google form link** available in the google classroom.

There are 5 (Five) Questions. Answer any 4 (Four).

Question 1. [Marks: 12.5]

a)	What are the major differences between AVR and 8051 microcontrollers? Explain why AVR uses LDI and LDS instructions.	**[6]**
b)	Write the instructions required to add -7 and -4. Show the value of the status registers V, N, S and P flags.	**[4]**
c)	Find the ROM memory address range of each of the following AVR chips: i. ATtiny25 with 2KB. ii. ATmega64 with 64KB.	**[2.5]**

Question 2. [Marks: 12.5]

a)	I_2C is a serial communication protocol which allows to connect multiple slaves to a single master, and multiple masters controlling single or multiple slaves. Now explain step by step how I_2C does this.	**[6]**
b)	What is the function of a watchdog timer?	**[4]**
c)	A DAC is showing 4.5 V output for the input code 1010101. Calculate the LSB and reference voltage if it operates within 2V and 12V.	**[2.5]**

Question 3. [Marks: 12.5]

a) In a AVR system, the IVT and the values of GPR and Stack at a certain time is given as shown below:

IVT		
#	**Address**	**Name**
5	AA08h	INT0
6	AA0Ah	INT1
7	AA0Ch	TIMER0
8	AA0Eh	TIMER1
9	AA10h	SP1

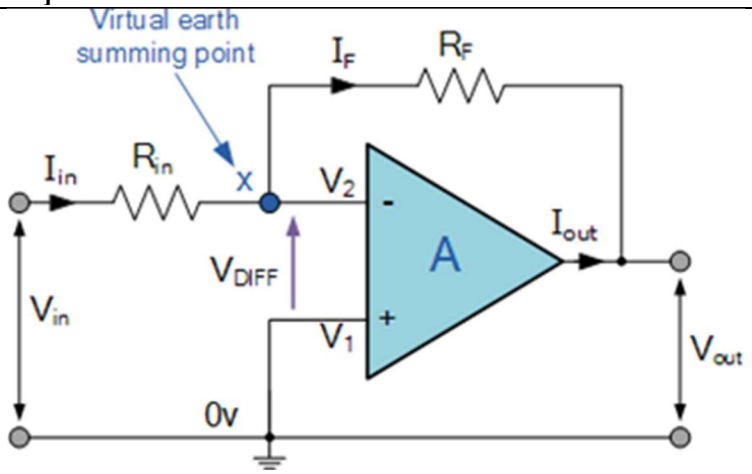
GPR	
R26	FFh
R27	05h
R28	F0h
R29	EFh
R30	15h
R31	00h

Stack	
FE05h	A5h
FE04h	DAh
FE04h	00h
FE02h	A4h
FE01h	B6h
FE00h	DCh

The following instructions are to be executed:

Address	Instruction
00A0h	SP←FE02h
00A2h	POP Z
00A4h	XOR R2, R2
00A6h	BLD Y, 0Dh
00A8h	BST R2, 02h

[5]

	After the execution of the instruction at 00A2h, INT0 and SP1 occurs at the same time. Which interrupt will be handled? After returning, the remaining instructions get executed. Explain the changes in **GPR, Stack, SP, PC** in every iteration and what are their final values?	
b)	We want to interface 512KB memory using 64KB memory modules with a 4B microcontroller. How many lines are required for addressing and decoding? Explain the memory map with necessary connection figures.	**[4]**
c)	What do you mean by UART? What are the different registers used in UART?	**[3.5]**
Question 4. [Marks: 12.5]		
a)	 For the figure above, let R_F = 10kΩ and Vin = 1V. Calculate I, V_o and A. Then prove that $I = \frac{Vin - V2}{Rin} = \frac{V2 - Vout}{Rf}$	**[5]**
b)	What is voltage follower and what is the purpose of using voltage follower?	**[3]**
c)	Suppose you are given an Ultrasonic sensor and 5 IR sensors. You have been asked to use them in the following applications. i. Water level measurement in tank. ii. Recognizing objects in distance. How could you utilize the sensors? Explain with proper reasoning.	**[4.5]**
Question 5. [Marks: 12.5]		
a)	Write an assembly program which will move 50H, 60H, 70H into R1, R2 and R3 registers of Bank1; move 2H and 4H into R0 and R2 registers of Bank3. After executing the above program, show the contents of the RAM locations. Then write PUSH instructions to push the contents of the registers on the stack and show the contents of it.	**[5]**
b)	Draw the frame format for the transmission of the ASCII character 'A' using the asynchronous serial mode. (ASCII value of 'A' is 01000001.)	**[1.5]**
c)	Make an Automatic Garden System (Design and Code) with Temperature sensor and Motor which turns on the Motor to sprinkle water when the temperature is above 35 degree celsius.	**[6]**