Name & Reg No: _____

Department of Computer Systems Engineering
University of Engineering & Technology
Peshawar

Microprocessor Based System Design (MBSD)
6th Semester Final-Term, Spring 2021

Max. Time: 3 hours **Max. Points: 50**

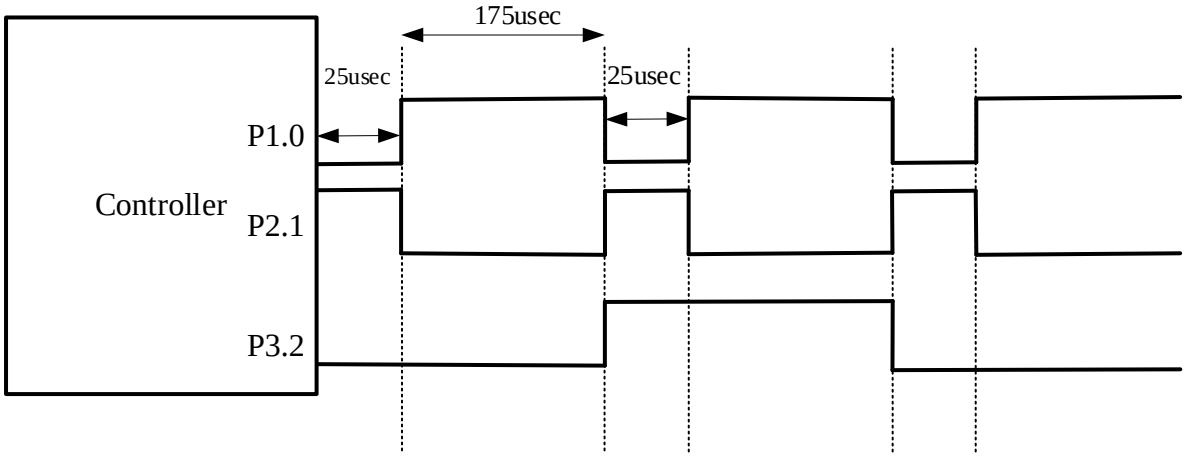
Instructions:

1. Attempt ALL questions.
2. Exam is open book and open notes.
3. Exam is worth **50%** of the final grade.

Q 1). **10-points**

Design CLO-2/PLO-1 [Cognitive Domain: Evaluation]

A. Analyze the timing diagram below and write the code for it to generate these periodic signals. Use timer interrupts for this purpose.



Show the three signals using oscilloscope in Proteus.
Can you generate all three signals using a single timer?
Submit the Proteus project along with the word file. The word file contains timing diagram of oscilloscope, schematics and code.

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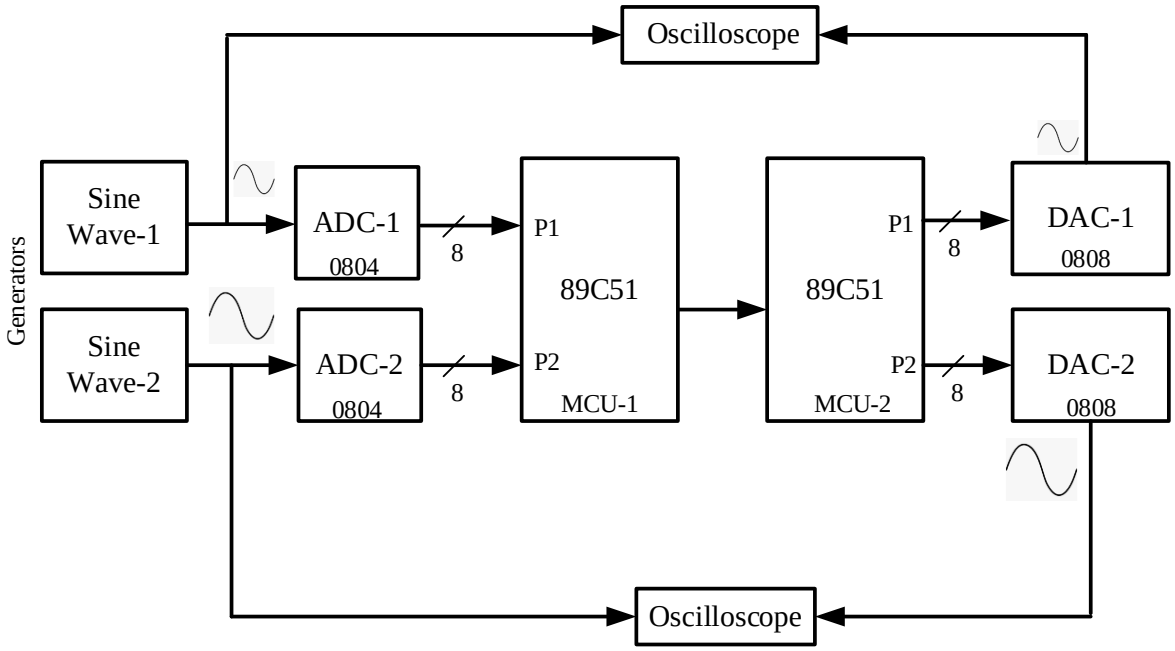
Q 2. **40-points**

CLO-5/PLO-3 [Cognitive Domain: Synthesis]



Implement the project as shown in the Figure above.
The oscillator frequency of both microcontrollers is fixed at **22.118MHz**. Keeping in view the **fastest possible transmission rate** of serial comm and ADC conversion rate. How much the frequency of input signals can be increased? Run the system at that frequency and write the code for it.

- MCU-1 sends serial data to MCU-2.
- Wave-1 is regenerated at DAC-1, as shown above.
- Wave-2 is regenerated at DAC-2, as shown above.
- Make it sure no loss of samples occurs during communication.
- Amplitude of Wave-1 is half of Wave-2.
- Goal is to maximize f_in1 and f_in2. Where f_inx is the frequency of input signal to ADC-x.

Answer the following questions, in a word file.

a. What will be transmission rate of MCU-1 and MCU-2 in bits per second.
b. What sampling rate will you choose for ADC-1 and ADC-2.
c. Assuming sampling frequency = (10 x Input sine wave frequency)
d. If you choose X Hz as the fastest possible frequency of input sine waves. Which component will be the problematic at (X+1) Hz. Will it be ADC, DAC, Serial Comm or something else? Prove mathematically.
e. Add the timing diagram of input sine wave signal and output of DAC. Show the amplitude and time period.
f. Can we sample both ADCs with the same sampling rate? Under what conditions we can do that?

Use timers for precise calculations.
Word file also contains the code. Zip both word file and Proteus file. Submit the zip file.