Task # 9: Serial Communication

MBSD @ DCSE, UET

Assigned by Dr. Bilal Habib

Deadline: July 11, 2022 (8 am) in class

In this project you are required to use two microcontrollers to communicate over serial lines as shown below in figure 1.

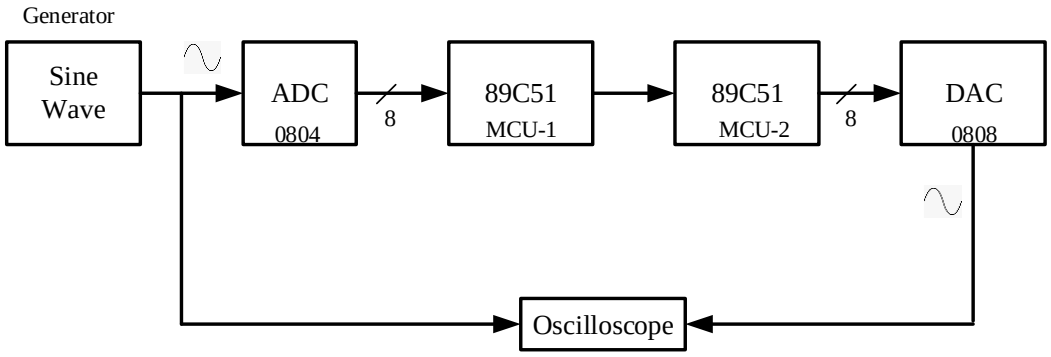

Figure 1: Block diagram of all the components

Design the following two cases A and B, and then answer questions in C.

A. Frequency of input sine wave (**f_in**) is 50Hz.
   a. Sampling rate (**fs)** of ADC = 500 samples/sec.
   b. Transmission rate of serial data is 9600 bps between MCU-1 and MCU-2.
   c. Oscillator frequency = 11.059MHz.

B. If oscillator frequency is fixed at 22.118MHz for both microcontrollers. Keeping in view the *fastest possible transmission* rate of serial communication and *ADC conversion rate*. How much the frequency of input signal can be increased? Run the system at that frequency in Proteus.

C. Discuss,
- Input signal to ADC has a frequency (**f_in)** of 50Hz. How you supplied it.
- What happens if you decrease the sampling rate (**fs**) from 500Hz, 400Hz to 100Hz samples per second for ADC?
- What reference voltage (**V_ref**) has been used for ADC?
- What is the relationship of **V_ref** to the amplitude of input signal?
- What will be the step-size?
- What is the input voltage range of ADC?
- Can we increase the frequency of input signal (**f_in)** to 10KHz, if not then why?
- If transmission rate is increased to 19,200 bps. Is your design able to handle input frequency (f_in) equal to 10KHz, without any loss of information? Assuming **fs** = = 10 x **f_in**.
- What is the limit of DAC, how fast it can work?

Bonus Part: Clean out the output of DAC using some low pass RC filter. Like one shown below, start from using small values of Capacitor like 10nF and go on increasing it.