

## 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.

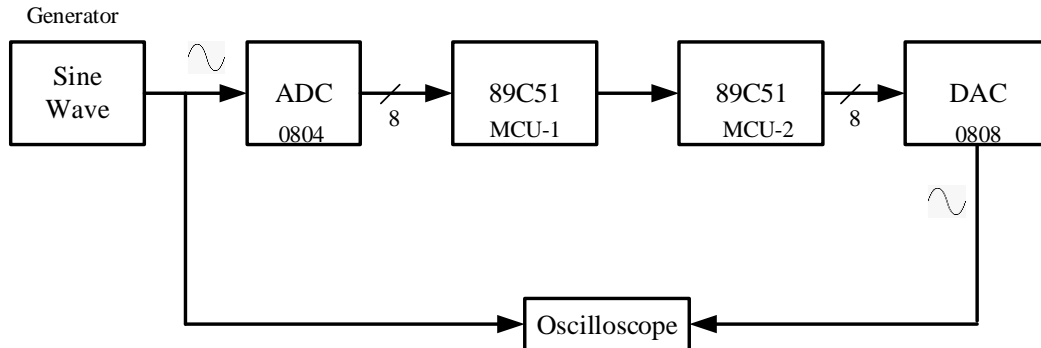


Figure 1: Block diagram of all the components

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

- A.** Frequency of input sine wave (**f<sub>in</sub>**) is 50Hz.
- Sampling rate (**f<sub>s</sub>**) of ADC = 500 samples/sec.
  - Transmission rate of serial data is 9600 bps between MCU-1 and MCU-2.
  - 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<sub>in</sub>**) of 50Hz. How you supplied it.
  - What happens if you decrease the sampling rate (**f<sub>s</sub>**) from 500Hz, 400Hz to 100Hz samples per second for ADC?
  - What reference voltage (**V<sub>ref</sub>**) has been used for ADC?
  - What is the relationship of **V<sub>ref</sub>** 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<sub>in</sub>**) to 10KHz, if not then why?
  - If transmission rate is increased to 19,200 bps. Is your design able to handle input frequency (**f<sub>in</sub>**) equal to 10KHz, without any loss of information? Assuming **f<sub>s</sub>** = 10 x **f<sub>in</sub>**.
  - 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.

