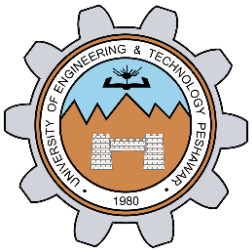
MICROPROCESSOR BASED SYSTEM DESIGN

TASK 11



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CSE307 MBSD

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Class Section: **B**

"On my honor, as student of University of Engineering and Technology, I have neither given nor received unauthorized assistance on this academic work."

Student Signature: _____

Submitted to:

Dr. Bilal Habib

Thursday, July 22, 2021

Department of Computer Systems Engineering

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Task:

Use serial communication to transfer data from MCU-1 to MCU-2 as shown below,

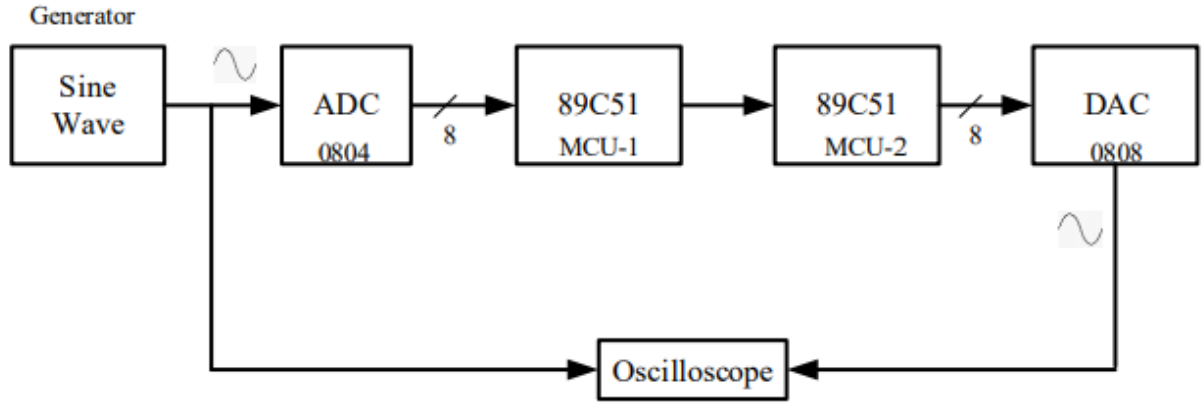
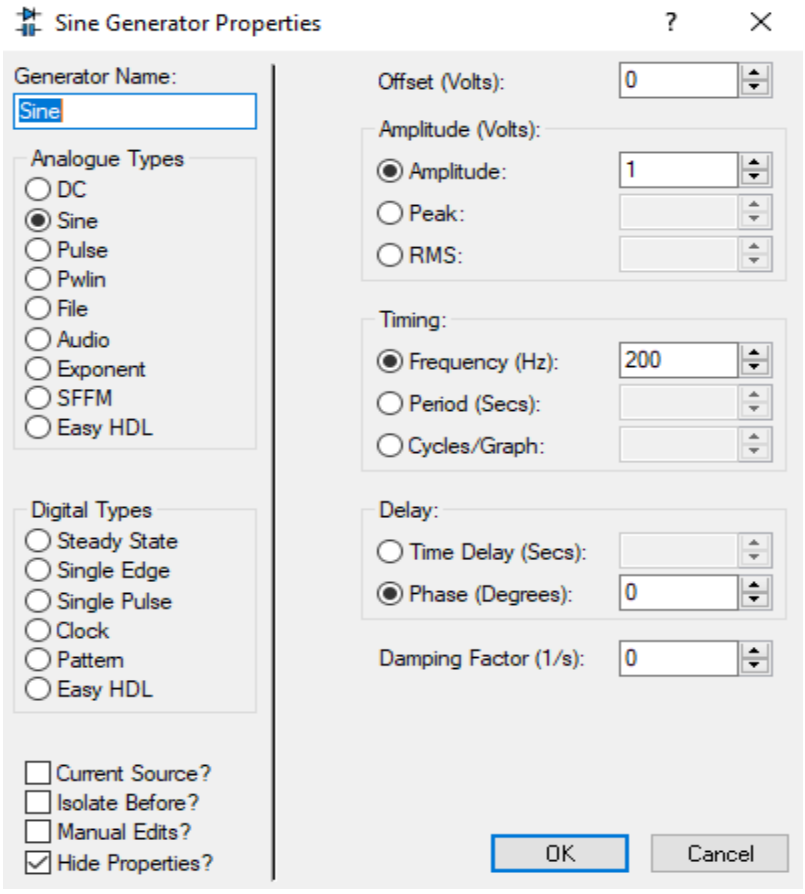


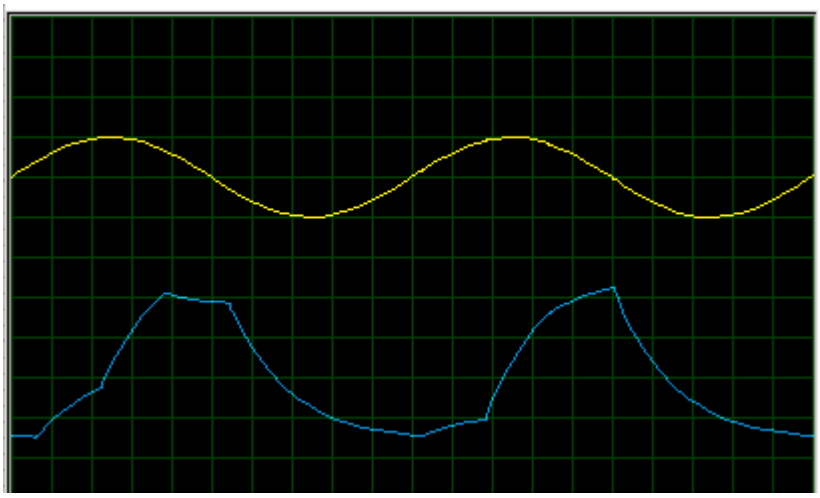
Figure 1: Block diagram of all the components

Show the original sine wave and the final output of DAC on the oscilloscope as shown in figure 1. If you see any distortions in the DAC output, clean them using filters. Written report must have answers of the questions below,

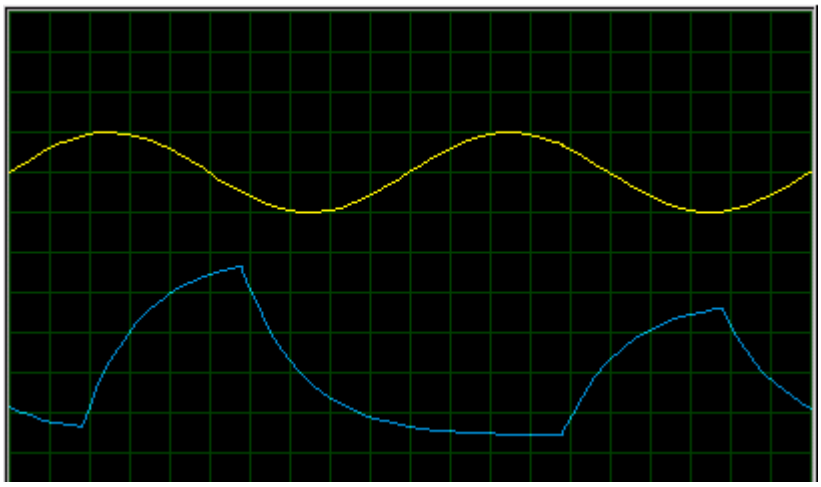
- **Input signal to ADC has a frequency (f_in) of 200Hz. How you supplied it.**
  Answer: I supplied this input frequency by editing the properties of sine generator.



- **What happens if you decrease the sampling rate (fs) from 2K, 1K to 0.5K samples per second?**
  Answer: If we decrease the sampling rate from 2k to 1K and then to 0.5K, the output signal will be distorted as we are not taking enough samples to reform the original signal.
  Output Signal (fs = 1K):



  Output Signal (fs = 0.5K):



- **What reference voltage (V_ref) has been used for ADC?**
  Answer: I have used 1V reference voltage for ADC in this task. I did this by supplying 0.5V at the $V_{ref}/2$ Pin of the ADC.

- **What is the relationship of V_ref to the amplitude of input signal.**
  Answer: The amplitude of input signal varies directly with the reference voltage. For example if Vref = 3V then we can supply an input signal with an amplitude of 3V.

- **What will be the step-size?**
  Answer: We know that Step-size = $Vin/2^n$
  So step-size = $1V/2^8 = 1V/256 = 3.90mV$

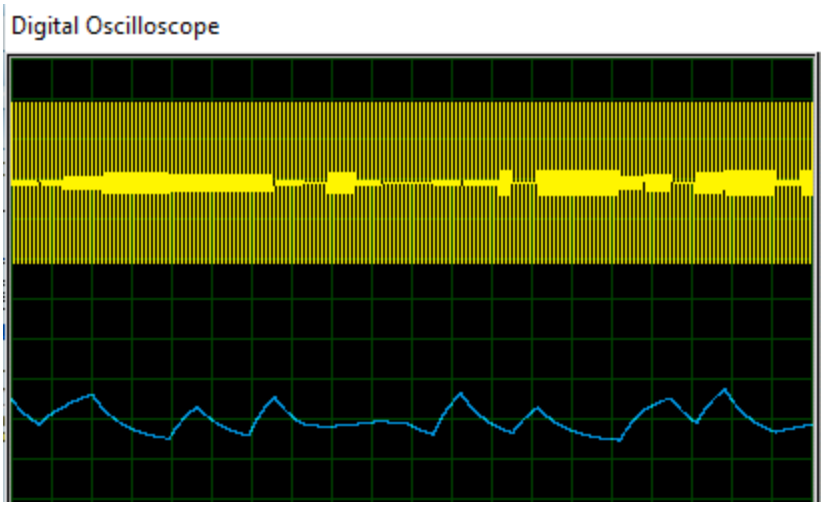
- **What is the input voltage range of ADC?**
  Answer: As my reference voltage is 1V so, the input voltage range of my ADC is 0V -1V.

- **Can we increase the frequency of input signal (f_in) to 10KHz, if not then why?**
  Answer: No, we cannot increase the frequency of input signal to 10KHz because we will need a sampling frequency of 1MHz for that, which is practically not possible to achieve.

- **Use a transmission rate of 9600 bps for serial data.**

```
TMOD = 0x20;    //Timer 1 mode 2
TH1 = 0xFD;     //9600 bps
SCON = 0x40;    //Mode 1 serial communication
PCON = 0x00;    //SMOD = 0
```

- **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.**
  Answer: No, my design will not be able to handle input frequency of 10KHz without any loss of information even if we increase the transmission rate to 19200 bps.



- **What is the limit of DAC, how fast it can work?**
  Answer: Number of DAC outputs = $2^n = 2^8 = 256$.
  The setting time of DAC is 150 ns which is very fast.

Code:

MCU 1:

```
#include <reg51.h>
#include <stdio.h>

sbit RD_n = P3^4; //P3.4 is connected to the RD pin of ADC
sbit WR_n = P3^5; //P3.5 is connected to the WR pin of ADC
sbit INTR = P3^2; //P3.2 is connected to the INTR pin of ADC

void main(void)
 {
   P1 = 0xFF; //Set P1 as an input Port
   INTR = 1; //Set P3.2 as an input pin
   TMOD = 0x20;            //Timer 1 mode 2
   TH1 = 0xFD;   //9600 bps
   SCON = 0x40; //Mode 1 serial communication
   PCON = 0x00; //SMOD = 0
   TR1= 1;                 //Start timer 1

  while (1)
  {
     RD_n = 1; //Set the RD pin to High
    WR_n = 0;//WR = Low
    WR_n = 1;//Low-->High
    while(INTR==1); //Wait for the ADC to Convert the given voltage
    RD_n = 0; //Set the RD pin of ADC from HIGH to LOW
    //The ADC sends the converted value to P1
    SBUF = P1; //Send the value at P1 to SBUF
    while(TI==0);           //While the SBUF is not transmitted, do nothing
    TI = 0;                 //Reset the TI bit to 0
   }
 }
```

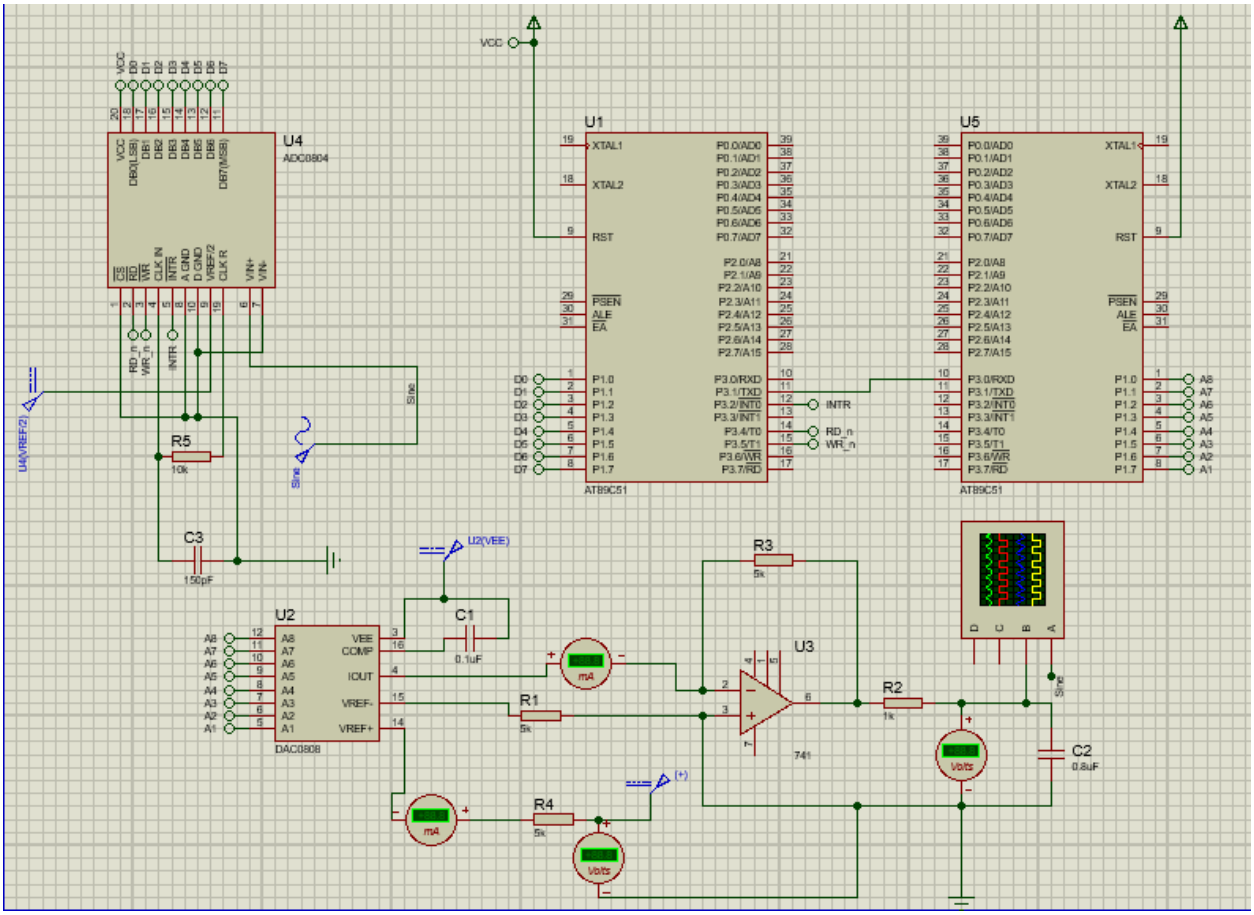
MCU 2:

```
#include <reg51.h>
#include <stdio.h>

void main(void)
 {
   P1 = 0x00; //Set P1 as an Output Port
   TMOD = 0x20;            //Timer 1 mode 2
   TH1 = 0xFD;   //9600 bps
   SCON = 0x50; //Mode 1 serial communication with REN bit set to 1
   PCON = 0x00; //SMOD = 0
   TR1= 1;                 //Start timer 1
  while (1)
  {
    while(RI == 0);         //While the value is not recieved, do nothing
    RI = 0;                 //Reset the RI bit to 0
    P1 = SBUF;   //Send the value recieved at SBUF to P1
   }
 }
```

Output / Graphs / Plots / Results:

Schematic:



Oscilloscope Output: