EE 337: Microprocessors Laboratory (Spring 2021)
Section: S2 (Third year UG)
Indian Institute of Technology Bombay

Lab 6: 20 points Date: March 10, 2021

1. [10 points] Write code to implement a simple reaction timer that works as follows and uses interrupts.

   i) Set the switch `SW1` in Off position. The program starts with a message on LCD as "Toggle SW1" on the first line and "when LED glows" on the second line. After displaying this message for 2 seconds, turn on the LED `P1.4`.

   ii) The user toggles `SW1` because of the displayed message. The LED should be turned Off as soon as the switch is toggled.

   iii) The program is expected to measure time between the instant the LED starts glowing and the instant the switch toggle is identified.

   iv) Next, the display on the LCD shows "Reaction Time" on the first line and the "Count is XX XXXX" on the second line. Assuming `T0` is used, display of count should be of 6 digits. First 2 digits show the number of times the timer has overflown, next 2 digits show the `TH0` value, next 2 digits show `TL0` value, each value in hexadecimal. This message is displayed for 5 seconds. *Note:* Optionally, you can display the time in `msec`.

   v) Go back to Step (i) and repeat the process continuously.

2. [10 points] Write code to generate two musical notes corresponding to the frequencies shown in Table 1. The musical notes can be generated as square waveform of specific frequencies. These can be generated and output using the speaker with appropriate interfacing.

   1. Use timer `T0` to generate the note (waveform) of appropriate frequency. Use timer `T1` to control the duration of the note. The output has to be written to port `P0.0`. Generate the two notes shown in Table 1 and let the duration of the notes be 2 s each. Do this continuously and verify the output using the debugger.
   2. Connect the speaker to the `Pt-51` kit using the SL100 transistor and interfacing circuit shown in Figure 1. You should be able to hear the notes being played out on the speaker.

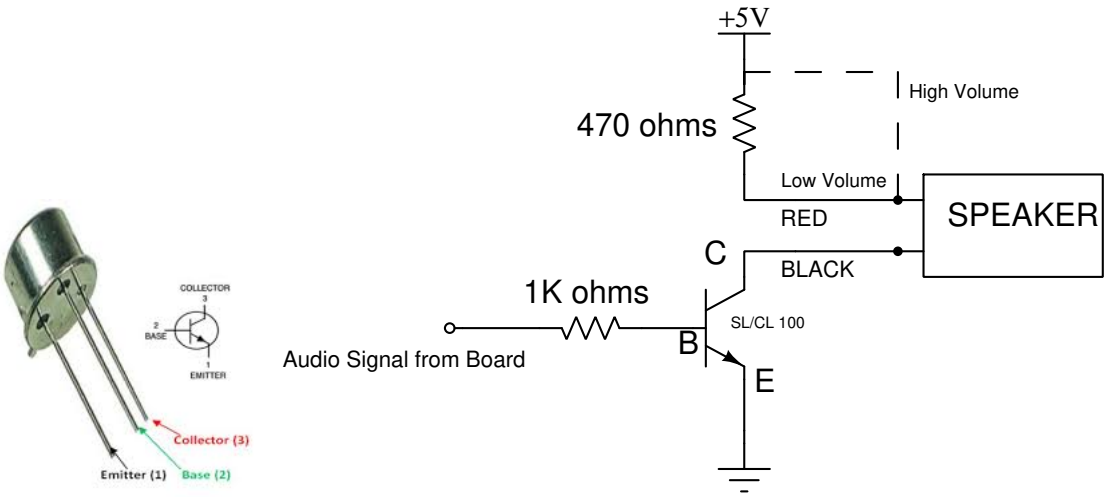
Table 1: Note frequencies.

S. No.	Note	Frequency
1	Sa	240
2	Re	270

TA Checkpoints

1. For question 1, ask the students to show the working of the reaction timer. Do this with short and long reaction times.

2. For question 2, check the appropriate waveforms on the logic analyzer (Keil). Also ask them to play out the notes.



(a) SL100 pinout

(b) Speaker driver circuit.

Figure 1: Circuit for interfacing Pt-51 with speaker.