# Microcontroller Laboratory

**Instructions:**

1. Each group should bring a cutter for stripping and cutting single-strand wires. No group will be allowed to work if the cutter is not brought.
2. Make sure that the components, breadboards, connectors issued to you are taken care of by you. Laboratory staff / TA cannot be held responsible for loss of issued items.
3. Breadboard wirings should be neat. Don't invite problems by creating a forest of hanging wires all around the board. Marks will be deducted for the same.
4. All the experiments should be completed within the specified time limit. Extending any experiment beyond stipulated time will incur penalty.
5. Whenever an experiment is over, make sure that it is checked by TA and marked in the register. No such argument like "I had shown it to TA" later will be entertained. Credit will not be given for any experiment that is not marked as "checked and evaluated" in the register.
6. Attendance is must. Any absence in the laboratory class may incur deduction of marks.
7. Laboratory reports are to be submitted on the very next day in the intinno page for the course. Delay in the process will incur penalty. Report should contain experiment name, objective, methodology, hardware design (if any) with explanation, software design with explanation, code (with documentation), results (if any), observations.
8. There is a folder in D: or E: drive in your PC named " Embedded-doc". The "pdf" file under the sub folder named "ESA51E-8051" within "Embedded-doc" explains the working environment. Everyone should go through this document before starting experiment.
9. **ALL INPUT / OUTPUT PORTS BE DRIVEN THROUGH BUFFER 74245. DO NOT DRIVE DIRECTLY FROM I/O PINS OF 8051 / 8255.**

# Experiments

**Experiment 1:** Familiarization with 8051 Kit.
**Time allocated:** 1 day

**Statement of the experiment:** Study about the kit components and its interface with the PC. Write the following programs in the assembly language of 8051.

1. Find the second largest of an array of 100 numbers stored in external memory from location 9000H onwards. The number be stored at location 9500H. Show the contents of memory locations before and after running the program to establish correctness of it
2. Compute the LCM of two numbers. Assume the numbers to be stored at location 9000H and 9001H. Store the result at 9002H.
3. Check whether a NULL-terminated string stored from location 9000H is a palindrome or not. If the string is a palindrome, store 1 at location 9500H, else clear the location.

**Experiment 2:** Traffic Light Controller.
**Time allocated:** 1 day

**Statement of the experiment:** Design a traffic light controller system that has four LEDs – RED, YELLOW, GREEN, ADVANCE GREEN. The sequence in which the LEDs are turned on is as follows: RED for 1 min, YELLOW for 15 seconds, GREEN for 1 min, ADVANCE GREEN for the last 10

seconds of GREEN. Interface a light-dependent resistor (LDR) with it. Whenever the LDR is covered, the controller goes to manual mode and all lights start blinking. The system returns to its normal condition as soon as the LDR is uncovered.

**Points to note:**

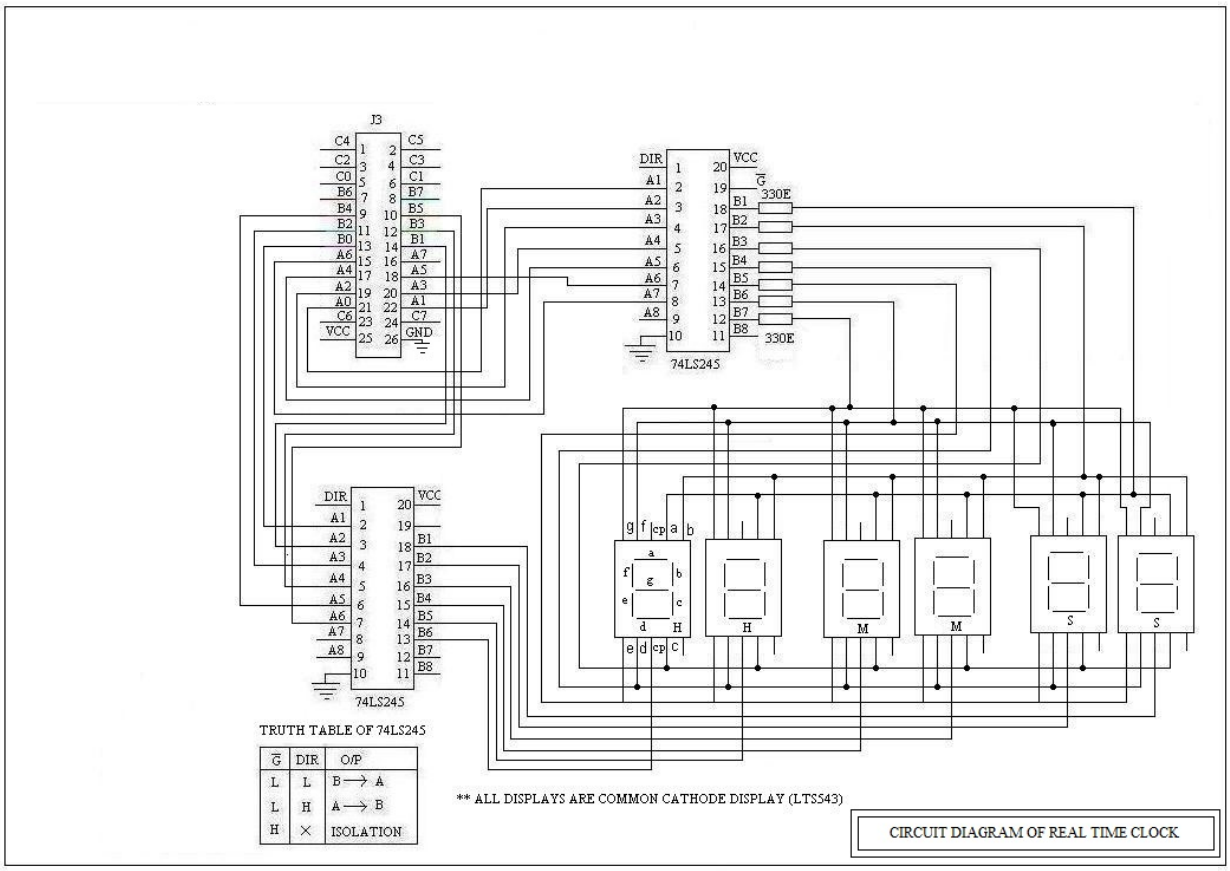
- Learn about port programming of 8051.
- Use 8051 ports to drive the LEDs.
- If necessary, interface drivers for better glow.
- Ensure that LEDs are connected via series resistors.
- Learn about LDR interfacing.
- You should show the two parts of the experiment separately to the TA and get evaluated.

**Experiment 3: Real-time clock/date display**.
**Time allocated:** 2 days

**Statement of the experiment:** Design a digital clock display using Common Cathode 7-segment display modules and a mode switch. The clock, normally displays the time in hh-mm-ss format. It updates the time automatically using the timer interrupt of the microcontroller. On pressing the mode switch, the display changes to date in dd-mm-yy format. On pressing the button once more, the display returns to show time.

**Points to note:**

- The interfacing of display modules and switch be done through 8255 ports. Learn about 8255 programming.
- For the kit, look into the manual and find out the port addresses.
- Make the display circuit as shown in the figure.
- Identify the patterns to be output to the ports for displaying digits.
- The time values are to be stored at location 9000H for hour, 9001H for minute and 9002H for second in a 24-hour format. Similarly the date values are to be stored at location 9003H for day, 9004H for month and 9005H for hour.
- The program should have an interrupt service routine that updates the time after every 1 second. Time updation may necessitate date updation as well. Learn about installation of ISR properly.
- Main program, after initialization of ISR, should work in a loop, looking for the pressing of switch. The display mode is selected accordingly. It then displays either the date or the time.




**Experiment 4: Waveform generation using DAC.**
**Time allocated:** 1 day

**Statement of the experiment:** Interface a DAC0808 chip with microcontroller and generate different waveforms, such as, (i) sinusoidal, (ii) triangular, (iii) saw-tooth. Calculate the maximum frequency and amplitude that you could achieve in each case.

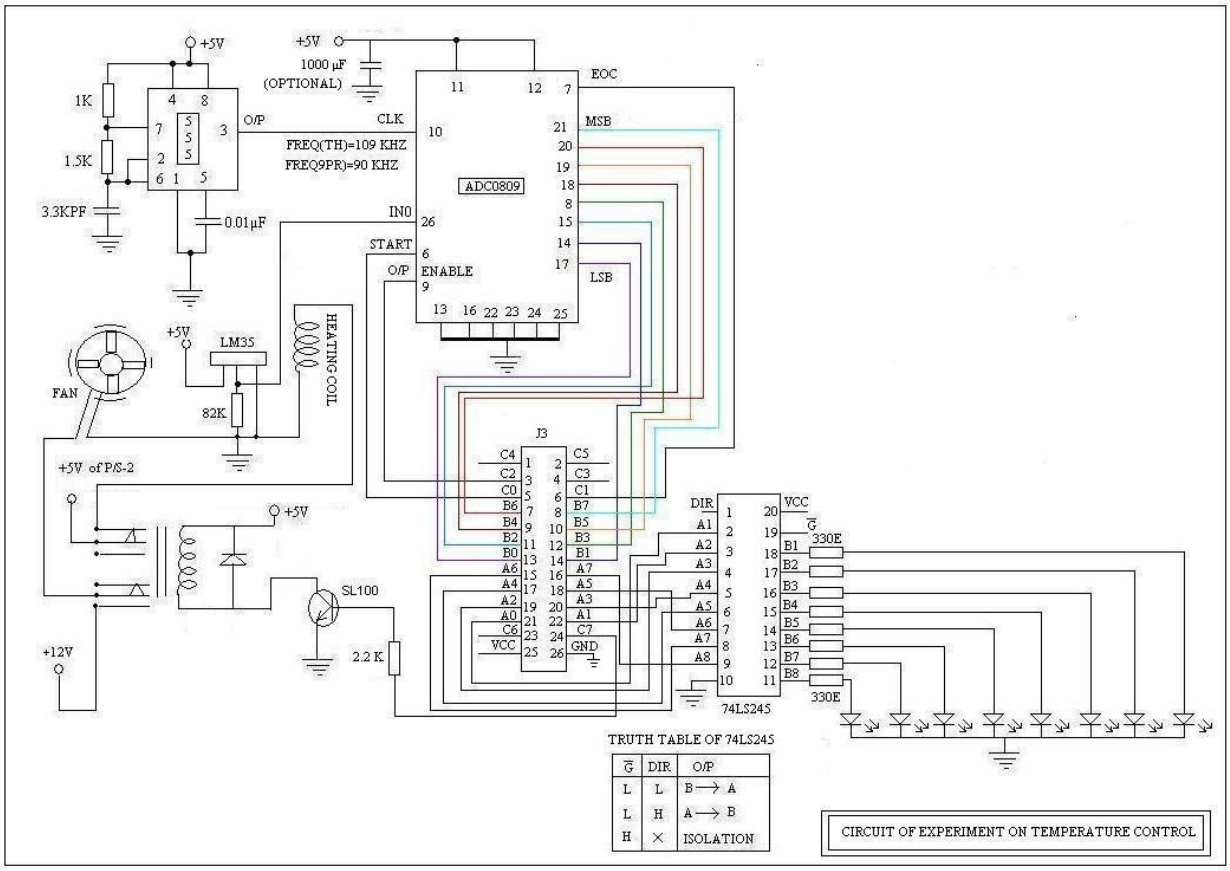
**Experiment 5: ADC interfacing.**
**Time allocated:** 2 days

**Statement of the experiment:** Design a temperature monitoring and control system. It uses a temperature sensor whose output is fed to the ADC. The ADC sends the digital output to the microcontroller. There are two cutoff temperatures – higher($55^0$C) and lower($45^0$C). A heating coil and a fan is interfaced with the microcontroller. The heating coil is turned on. If the temperature is more than the higher cutoff, a relay is triggered to turn on a fan working at 12V, the coil is turned off. Again when the temperature comes down to the lower preset value, the fan is turned off and the coil is turned on.

**Points to note:**

- Study the circuit shown in the figure for the interface.
- Identify the ADC count values corresponding to the two cutoffs. These values are to be used by the program to check the temperature values.

- You first do the ADC interfacing portion. Show that, varying the input via pot, the count value is changing. You can interface eight LEDs to show the value read from the ADC. Get it marked by the TA. Only after that proceed with the second portion.




**Experiment 6: Stepper motor interfacing.**
**Time allocated:** 1 day

**Statement of the experiment:** Interface a stepper motor with the microcontroller. The system will have two switches. Initially, the motor is at zero speed. With every press of the first switch, the speed will increase by a fixed amount. After eight such presses, it returns to zero speed. The other switch will toggle the direction of rotation of the motor.

**Experiment 7: Serial communication between kits.**
**Time allocated:** 1 day

**Statement of the experiment:** Interface two kits using UART interface of 8051.

**Experiment:** **LCD display interfacing**
**Time allocated:** **1 day**

**Statement of the experiment:** Interface an LCD display with the microcontroller through 8255 port (J3). Display your name and Roll no. in the 1st line and Hall address in the 2nd line. Make it a scrolling display.