ME5627 Measurements in Thermofluids

Laboratory Record

Submitted By

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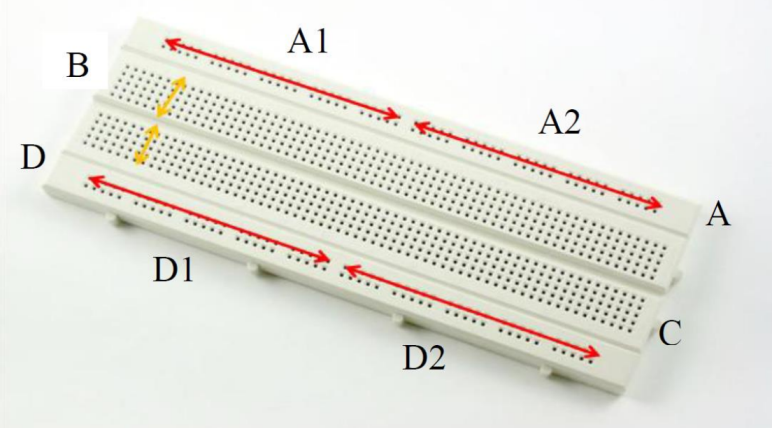
EXPERIMENT 1

PART A: FAMILIARISATION WITH PC SCOPE AND BREAD BOARD THROUGH RC CIRCUIT

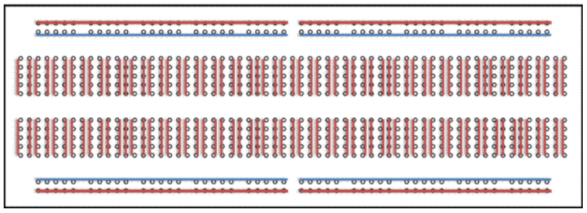
Aim – To gain familiarity with Bread Board, oscilloscope and oscilloscope data logger through RC circuit

Apparatus – Bread board, wires, Oscilloscope, Resistor, capacitor

Details of Bread Board:



(a) Schematic of the Bread Board



(b) Equipotential lines

Figure 1.1: Breadboard familiarisation

- Hold the breadboard such that the horizontal side is longer than the vertical side.
- There are four independent portions (A, B, C and D) created by three notches as in Fig. 1.1a. Here, independence means portions A, B, C and D are not connected with each other

Portion A and D

- Each portion of A and D is further subdivided into two regions as A1 and A2 shown in Fig. 1.1.
- Each horizontal line (shown through arrows in the Fig. 1.1a) of A1, A2, D1 and D2 represent a single potential. Usually, as a general practice, these points are considered as ground for a given built circuit.

Portion B and C

- In portion B and C, each vertical line (shown through arrows in Fig. 1.1a) of B and C represents a single potential.
- The above explanation can be better understood through Fig. 1.1b showing same potential lines.

Details of oscilloscope probe

Fig. 1.2 shows a typical oscilloscope probe.

- The Oscilloscope probe is a passive connector which is used to connect oscilloscope to the electrical circuit. It consists of three parts Retractable hook tip (or crocodile clip), a Crocodile clip and BNC connector.
- BNC connector: It is used to connect oscilloscope to the probe.
- Retractable Hook tip: It is used to connect the node of the electrical circuit to the oscilloscope where there is a need to measure the signal.

- Crocodile clip: It is connected to the ground of the electrical circuit in the bread board.
- Make sure the RED slider on the probe should be on the X1 position only. X1 means amplification is unity.

Figure 1.2: PC scope probe

Fig. **??** shows a four channel Oscilloscope with digital data storage system. There are four channels which displays the input/output signal. Input and output probes may be connected to any of these four channels to visualize and analyze the waveforms of the signal. There are scaling, vertical and horizontal controls to adjust the waveform in order to have better visualization. Peak to peak voltage and time scale can be conveniently read from the monitor using the adjustment knob after pressing the cursor button.

In order to obtain a desired input signal (sinusoidal, square, ramp, pulse or any arbitrary waveform) a function generator can be used (Fig. **??**). The desired amplitude and frequency of the waveform can be obtained using the side controls near the monitor. The output probes may be connected to any of the two channels. One of the crocodile clip of the output probe needs to be grounded and the other end can be given as input signal to generate the signal in the circuit. Also, in order to check whether the function generator is working, the probe may be connected to the Oscilloscope.

Calculation of Resistance:

- Turn the resistor so that the gold or silver stripe is at the right end of the resistor.
- Look at the color of the first two stripes on the left end. These correspond to the first two digits of the resistor value. Use the table given below to determine the first two digits.
- Look at the third stripe from the left. This corresponds to a multiplication value. Find the value using the table below.
- Multiply the two digit number from step two by the number obtained from step three. This is the value of the resistor in ohms. The fourth stripe indicates the accuracy of the resistor.

Sample:

You are given a resistor whose stripes are colored from left to right as brown, black, orange, gold. Find the resistance value.

- The gold stripe is on the right so go to Step Two.
- The first stripe is brown which has a value of 1. The second stripe is black which has a value of 0. Therefore the first two digits of the resistance value are 10.
- The third stripe is orange which means x 1,000.
- The value of the resistance is found as 10 x 1000 = 10,000 ohms i.e., 10 kΩ
- The gold stripe means the actual value of the resistor may vary by 5% meaning the actual value will be somewhere between 9,500 ohms and 10,500 ohms. (Since 5% of 10,000 = 0.05 x 10,000 = 500)

Calculation of Capacitance: Sample Calculation:

- Step 1: In the Fig. **??**, the first two digits from the left indicates the first two digits of the capacitor value. Here, in this case the first two digits are 1 and 0. Therefore, the first two digits of the capacitor value is 10.
- Step 2: The third digit is 4 which means that four zeroes would be followed by 1 (10,000 pF).
- The value of the capacitor is found out to be the product of the number obtained in step 1 and step 2. That is, 10 $\times$ 10000 = 10,0000 pF i.e 0.1 μF.

Experiment 2