Daffodil International University (DIU)
Department of Electrical and Electronic Engineering

EEE 422: Measurement and Instrumentation Lab

EXPERIMENT NO: 05

NAME OF THE EXPERIMENT: STUDY OF BASIC DIFFERENTIAL AMPLIFIER.

Theory:
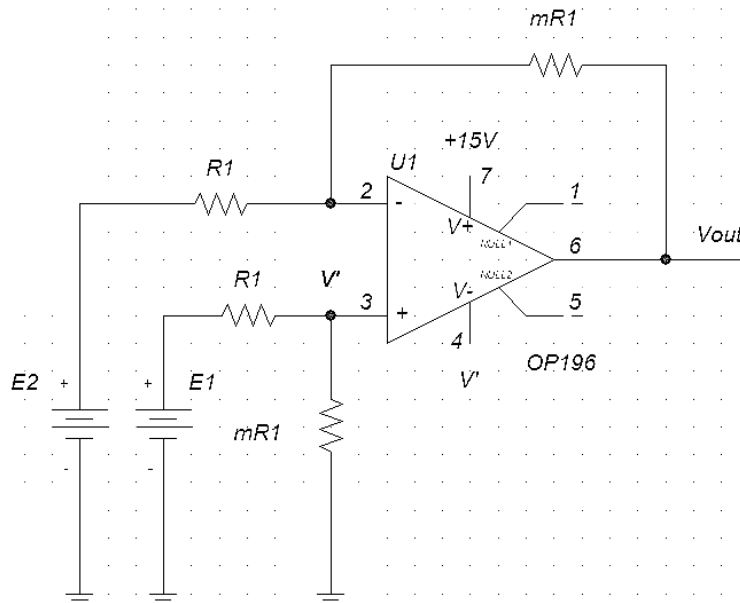Figure 01 shows the basic differential amplifier

Fig. 1: Basic differential amplifier

If E_1 is replaced by a short circuit, E_2 sees an inverting amplifier with a gain of –m. Therefore, the output voltage due to E_2 can be found by,

$$\frac{V_0}{mR_1} = -\frac{E_2}{R_1}$$

$$V_{0} = -mE_2$$

If E_2 is replaced by a short circuit, E_2 sees an non-= inverting amplifier with a gain of –m. Therefore, the output voltage due to E_1 can be found by,

$$V_0 = mE_1$$

Final output

$V_0 = m(E_1 - E_2$

List of Equipment:

1. Op-amp(1 unit)
2. Resistors 1k(2 Nos.), 10k (2 Nos.) and 33k(1 No.)
3. Potentiometer (50k)
4. Multimeter (1 unit)
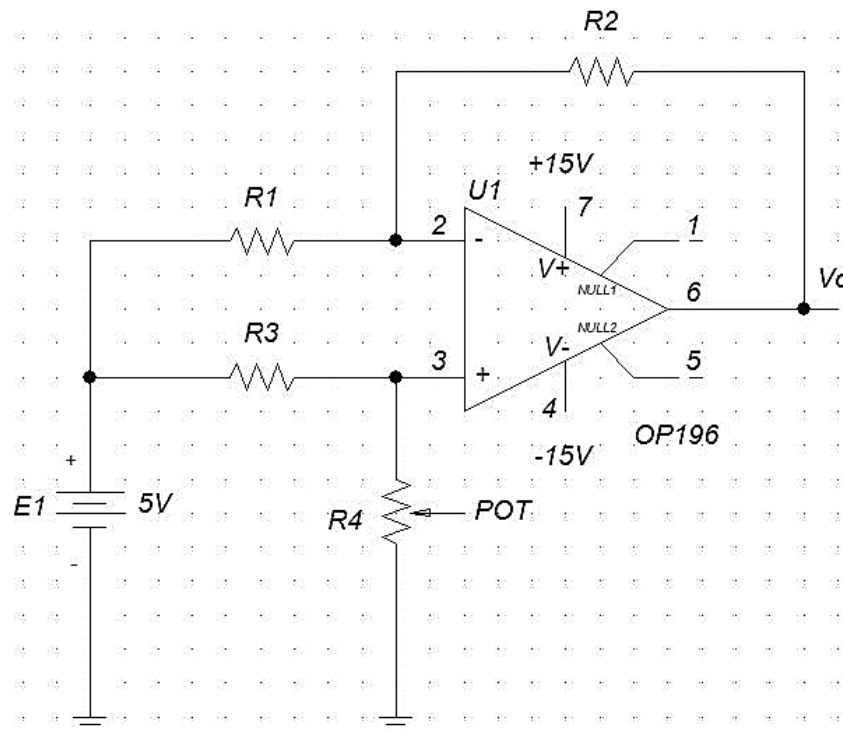5. Trainer Board and
6. DC Power Supply

Circuit Diagram:

Figure 02: Circuit diagram for experiment

Procedure:

1. Measure the resistances and set up the circuit as shown in the figure 02. Use $R_1=R_3=10k$, $R_2=33k$ and 50k potentiometer as R_4.

2. Vary the potentiometer so that output voltage becomes zero. In this Connection the input voltage is called the common-mode-input voltage, E_{cm}. Now V0will be zero if the resistor ratios are equal. This causes the common-mode-voltage gain, V_0/E_{cm} to approach zero. It is the characteristic of a differential amplifier that allows a small signal voltage to be picked out of a larger noise voltage.
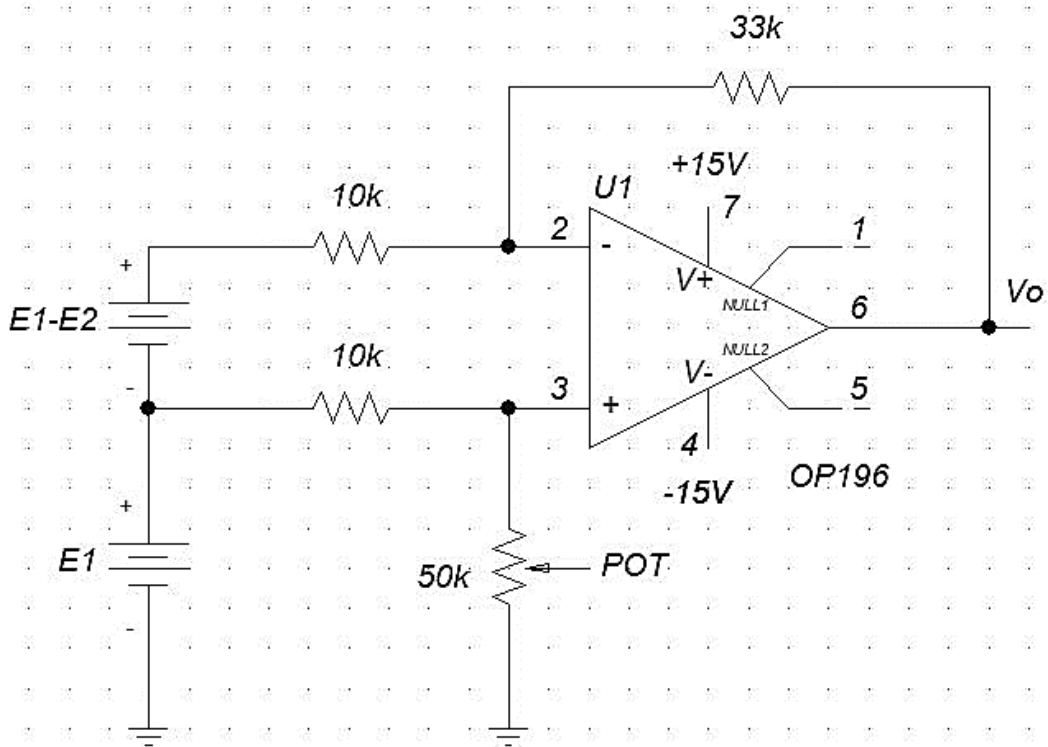
3. Set up the circuit as follows:

Figure 03: Setup

4. Vary the (E_1-E_2) from 0V to 6V with a step of 0.5 V and measure V_0. Record the data in the following table.

Input Voltage (E_1-E_2)	Output Voltage, V_0
0.5	
1.0	
1.5	
2.0	
2.5	
3.0	
3.5	
4.0	
4.5	
5.0	
5.5	
6.0	

5. Plot the V_0 versus (E_1-E_2)

6. Change E_1 to -5V and repeat the procedure with $R_1=R_2=1k$, $R_3=10k$ and R_4 with 50k potentiometer. Take reading in the following table:

Input Voltage (E_1-E_2)	Output Voltage, V_0
0.5	
1.0	
1.5	
2.0	
2.5	
3.0	
3.5	
4.0	
4.5	
5.0	
5.5	
6.0	

Report:

1. Calculate the theoretical gain of the basic differential amplifier for both the cases.
2. Write down the disadvantages of a basic differential amplifier.
3. Calculate the value of the input resistance for E_1-E_2=3V for each case E_1=-5V and E_2=+5V.