EXPERIMENT

IMPLEMENTING AND DESIGNING SUMMING AND DIFFERENTIAL AMPLIFIER USING OP-AMP

Objective

The purpose of this experiment is to implement and design summing amplifier (both inverting and non-inverting) and differential amplifier in breadboard and LTSpice using op-amp uA741.

Tasks

1. **Inverting summing amplifier (Breadboard and LTSpice implementation)**
    a. Implement the circuit given in figure 1 in **breadboard**.
    b. Measure and record V1, V2 and V_out voltages.

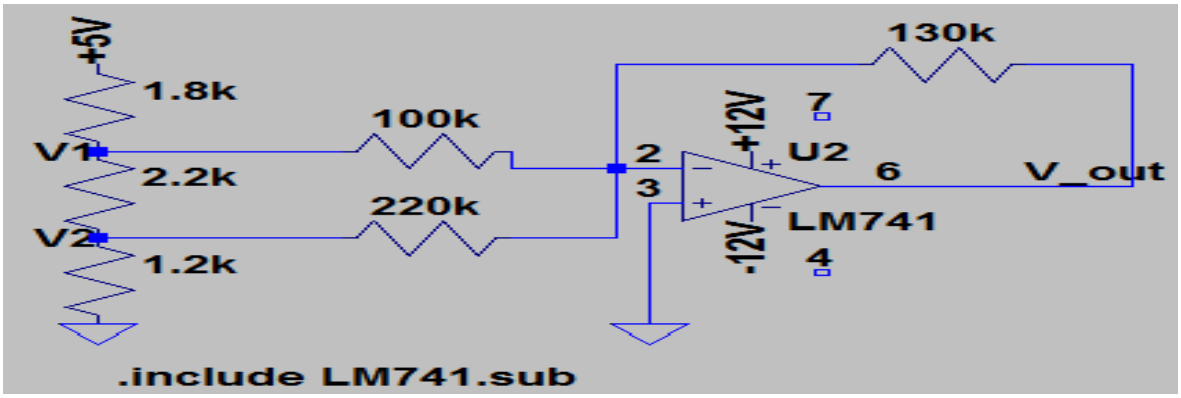

Figure 1

    c. Implement the circuit given in figure 1 in **LTSpice** and repeat step 1(b).
    d. Derive an expression for the output voltage in terms of voltages V1 and V2 using **hand analysis**. Assume V1 and V2 to be equal to the value measured in step 1(b).
    e. Verify the results (voltage V_out) as obtained from steps 1(b), (c) and (d).

2. **Differential Amplifier (Breadboard and LTSpice implementation)**
    a. Implement the circuit given in figure 2 in **breadboard**.

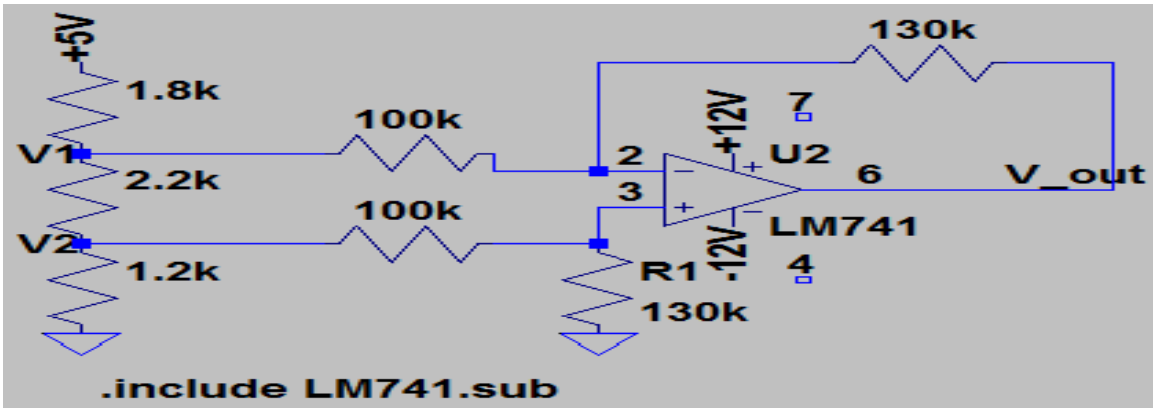

Figure 2

b. Measure and record V1, V2 and V_out voltages.

c. Implement the circuit given in figure 2 in **LTSpice** and repeat step 2(b).

d. **Hand Analysis** - The expression for the output voltage in terms of voltages V1 and V2 is given by

$$V_{out} = \frac{R_2(V_2 - V_1)}{R_1}$$

Assume V1 and V2 to be equal to the value measured in step 2(b). R2 is 130k and R1 is 100k.

e. Verify the results (voltage V_out) as obtained from steps 2(b), (c) and (d).

3. Non-Inverting Summing Amplifier (LTSpice implementation)

a. Implement the following expression of V_out as a non-inverting summing amplifier using op-amp in **LTSpice**. Assume suitable resistances to get the required gain. Use the methodology as explained in lecture 12.

$V_{out} = 10 V_1 + 3 V_2 + 8 V_3 + 0.6 V_4$

END