EE230: Lab 6 (Offline)
Measuring Opamp Non Ideal Parameters

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1 Overview of the experiment

1.1 Aim of the experiment

To obtain the values of non ideal parameters of Operational Amplifier - Offset Voltage, Input Bias Current and Open Loop Gain.

1.2 Procedure Followed

The operational amplifier was first connected like in Fig 1 and the output voltage was measured on the DMM, then the offset voltage was measured as $V_{OS} = \frac{V_o}{1+\frac{R_2}{R_1}}$. The operational amplifier was then connected as in Fig 2 and Fig 3 and I_B^+ and I_B^- were estimated as $\frac{V_o}{R}$, R here is the 10M resistor.
The operational amplifier was then connected as in Fig 4 as DUT and the potentiometer was adjusted to make $V_o \approx 0 = V_{oA}$ when switch was in position 1. Then the switch was moved to position 2 and V' was applied to the node, output voltage was measured as $V_o = V_{oB}$. Then the openloop gain was measured as $A_{OL} = \frac{-V'(R_2+R_3)}{R_2(V_{oB}-V_{oA})}$. The value of A_{OL} was measured for V'= 1V,2V,3V.
The values obtained were compared with the values written the datasheet for the operational amplifier used.

2 Design

2.1 Circuit Diagrams

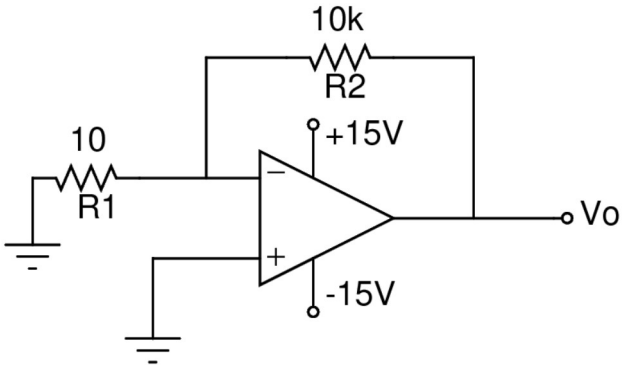

Fig 1: Circuit to find Offset Voltage (V_{OS})

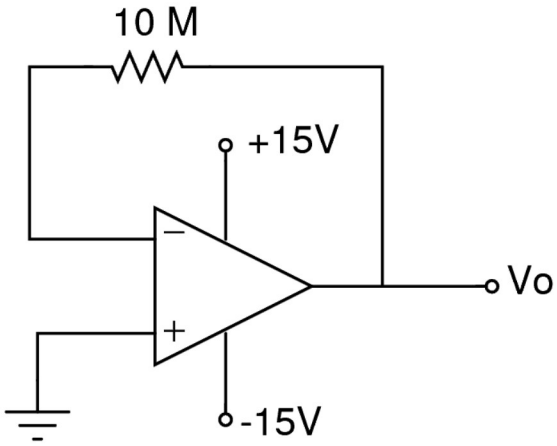

Fig 2: Circuit to find I_B^-

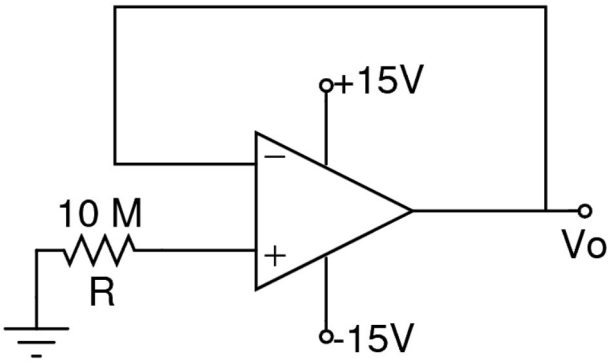

Fig 3: Circuit to find I_B^+

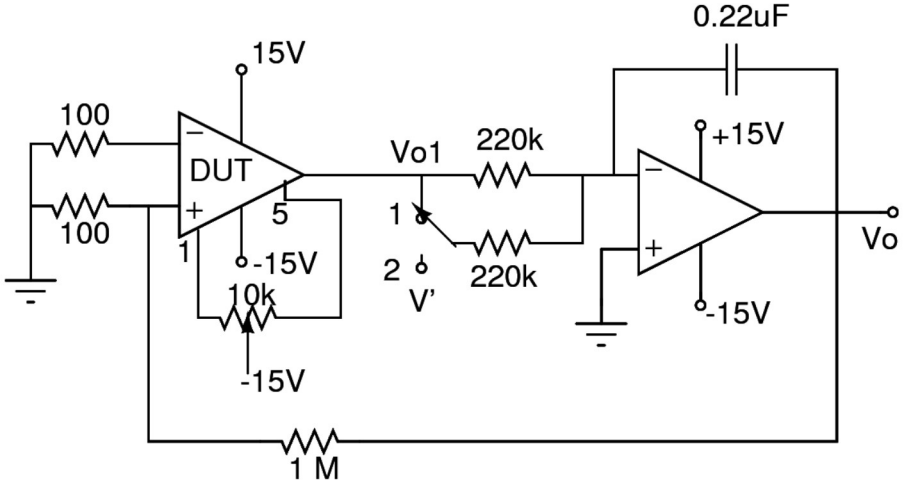

Fig 4: Circuit to find Open Loop Gain (A_{OL})

3 Experimental Results

3.1 Readings obtained compared with datasheet

3.1.1 URL to Datasheets

(https://www.ti.com/lit/ds/symlink/ua741.pdf)
(https://www.ti.com/lit/ds/symlink/lm741.pdf?HQS=TI-null-null-alldatasheets-df-pf-SEP-wwe&ts=1646517394482&ref_url=https%253A%252F%252Fpdf1.alldatasheet.com%252F)

3.1.2 Offset Voltage

Opamp	Experimental Offset Voltage	Datasheet Offset Voltage (TYP)
UA741CP	0.45mV	1mV
LM741CN	0.74mV	2mV

3.1.3 Input Bias Current

Opamp	I_B^-	I_B^+	Experimental $I_B = \frac{I_B^+ + I_B^-}{2}$	Datasheet I_B (TYP)
UA741CP	31.4nA	32nA	31.7nA	80nA
LM741CN	54nA	54nA	54nA	80nA

3.1.4 Open Loop Gain

DUT	V_{oA}	V_{oB}	V'	Experimental A_{OL}	Datasheet $A_{OL} = A_{VD}$ (TYP)
UA741CP	7mV	-10mV	1V	5.88×10^5	2×10^5
UA741CP	7mV	-30mV	2V	5.40×10^5	2×10^5
UA741CP	7mV	-45mV	3V	5.77×10^5	2×10^5

4 Conclusion

Thus the non ideal parameters of operational amplifiers calculated experimentally and theoretically mentioned as per the datasheet are of the same order and thus similar within experimental limits.