

ALL PRE-LAB ANSWERS MUST BE SUBMITTED THROUGH CANVAS BEFORE OCTOBER 2

CANDIDATES WITH NO SUBMISSION WILL NOT EARN ANY MARKS FOR LAB 2

Pre-Lab Assignment 2: Operational Amplifiers

This assignment contains two pages.

You may assume that the op amps are ideal in all cases.

Please note that **only the numerical values** to the answers for the following questions are required for submission on Canvas. **Pay attention to the units specified by each question.**

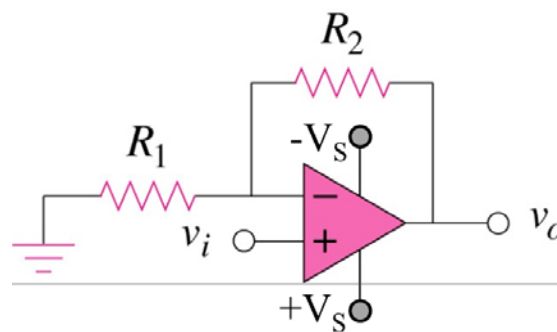


Fig 1: Circuit for questions 1 to 4

Referring to the circuit shown in Fig 1, where $V_S = 5\text{ V}$, $R_1 = 500\ \Omega$, $R_2 = 2.5\text{ k}\Omega$

1. If $v_i = 0.3\text{ V}$, determine the voltage at the inverting input of the op amp **in V**.
2. Determine the closed-loop gain (v_o/v_i) of the circuit.
3. Estimate the maximum possible value of v_o **in V**.
4. Determine the current supplied by the input source v_i **in mA**.

Remaining questions on the next page

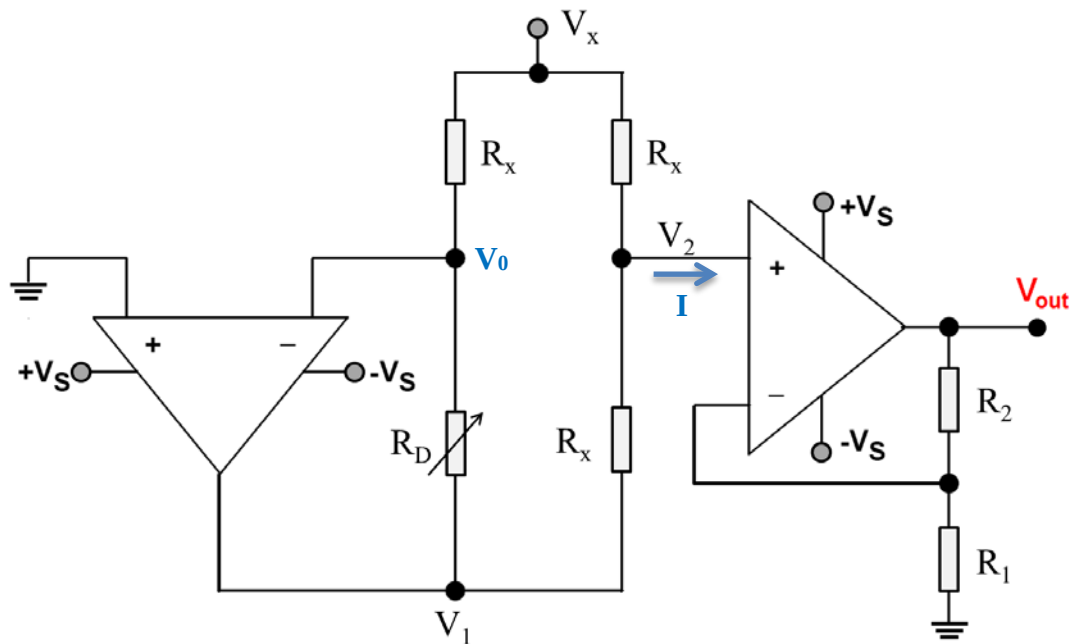


Fig 2: Circuit for questions 5 to 14

Referring to the circuit shown in Fig 2, given $V_x = 1\text{ V}$, $R_D = R_0(1 + \alpha T)$ where T is the temperature in $^{\circ}\text{C}$

5. If R_0 is the resistance of a Resistance Temperature Detector (RTD) at $0\text{ }^{\circ}\text{C}$, determine the value of R_0 from the data sheet (model TD5A) **in $\text{k}\Omega$** .
6. From the data sheet of the RTD (model TD5A), determine the value of α **with units $10^{-3}/^{\circ}\text{C}$** .
7. Determine V_0 **in V**.
8. If $R_x = R_0$, determine the current through R_D **in mA**. *Preparation note: you will need to choose a suitable value for R_x based on the available resistor values when you build this circuit in Lab 2.*
9. If $R_x = R_0$, at $T = 25\text{ }^{\circ}\text{C}$, determine V_1 **in V**.
10. Determine the current I at $T = 25\text{ }^{\circ}\text{C}$ **in mA**.
11. Then determine V_2 when $T = 25\text{ }^{\circ}\text{C}$ **in mV**. *Preparation note: you will need this value to compare against experimental data in Lab 2.*
12. Given R_2 and R_1 have the same values as in Fig 1, determine V_{out} when $T = 25\text{ }^{\circ}\text{C}$ **in mV**. *Preparation note: you will need this value to compare against experimental data in Lab 2.*
13. Determine the slope of the graph of V_2 versus T **with units $\text{V}/^{\circ}\text{C}$** . *Preparation note: you will need this value to compare against experimental data in Lab 2.*
14. Determine the slope of the graph of V_{out} versus T **with units $\text{V}/^{\circ}\text{C}$** . *Preparation note: you will need this value to compare against experimental data in Lab 2.*