**SEL0313 – Circuitos Eletrônicos I**
Lista de Exercícios 1
(Amplificadores Operacionais)

Exercício 1

Consider the single op-amp difference-amplifier circuit for the case $R_1=R_3=2k\Omega$ and $R_2=R_4=200\ k\Omega$. The resistors have 1% tolerance.

a) Find the interval value of the differential gain A_d.

b) Find the interval values of the differential input resistance R_{id} and the output resistance R_o.

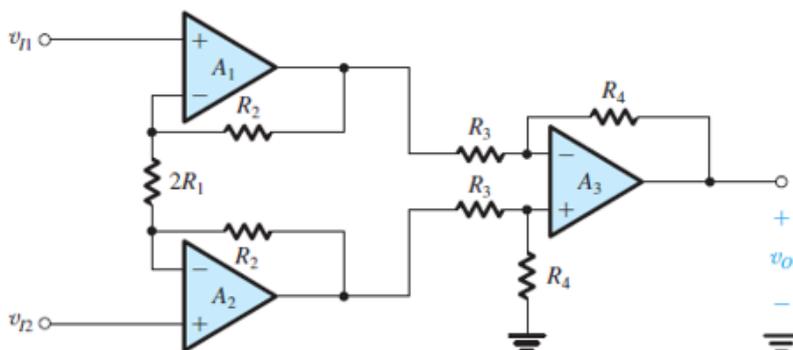**c)** The best-case and worst-case common-mode gain A_{cm} and the corresponding value of CMRR.
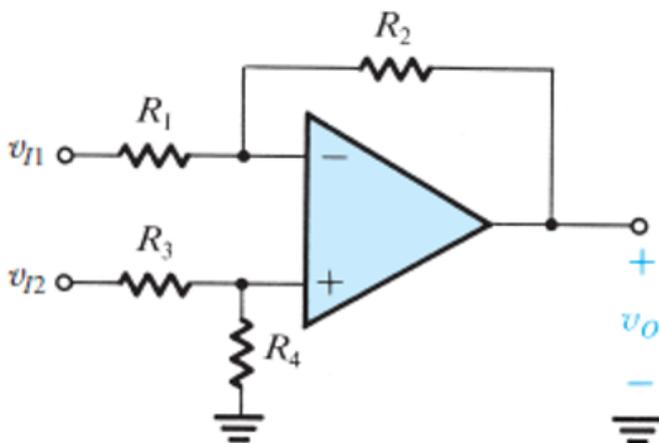
$$A_d = \frac{R_2}{R_1}$$

$$R_{id} = 2\,R_1$$

$$A_{cm} = \frac{R_4}{R_4 + R_3}\left(1 - \frac{R_2}{R_1}\frac{R_3}{R_4}\right)$$

Exercício 2

Design an instrumentation amplifier to provide a gain that can be varied over the range of 2 to 1000 utilizing a 100-kΩ variable resistance. Consider $R_3 = R_4$.

$$v_O = \frac{R_4}{R_3}\left(1 + \frac{2R_2}{2R_1}\right)v_{Id}$$

An op amp has a rated output voltage of ± 10V. and a slew rate of 1 V/µs.

a) What is its full-power bandwidth ?

b) If an input sinusoid with frequency $f = 5f_M$ is applied to a unity-gain follower constructed using this op amp, what is the maximum possible amplitude that can be accommodated at the output without incurring SR distortion?

Consider the noninverting amplifier circuit shown below. The circuit is designed for a nominal gain (1+ R_2 /R_1)=10V/V. It is fed with a low-frequency sine-wave signal of peak voltage V_P and is connected to a load resistor R_L. The op amp is specified to have output saturation voltages ± 13V and output current limits of ± 20mA.
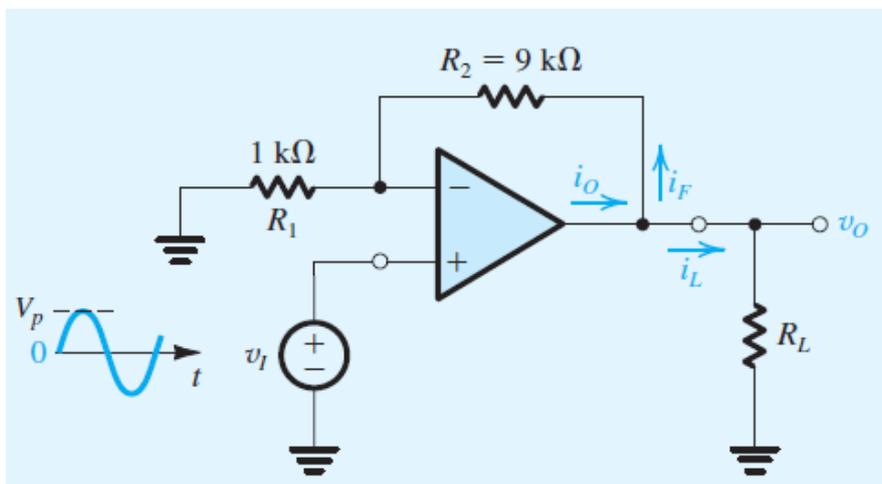
Non-inverting Amplifier

a) For V_p = 1 V and R_L = 1 kΩ, specify the signal resulting at the output of the amplifier.

b) For V_p = 1.5 V and R_L = 1 kΩ, specify the signal resulting at the output of the amplifier.

c) For R_L = 1 kΩ, what is the maximum value of V_p for which an undistorted sine-wave output is obtained ?

d) For V_p = 1 V, what is the lowest value of R_L for which an undistorted sine-wave output is obtained?