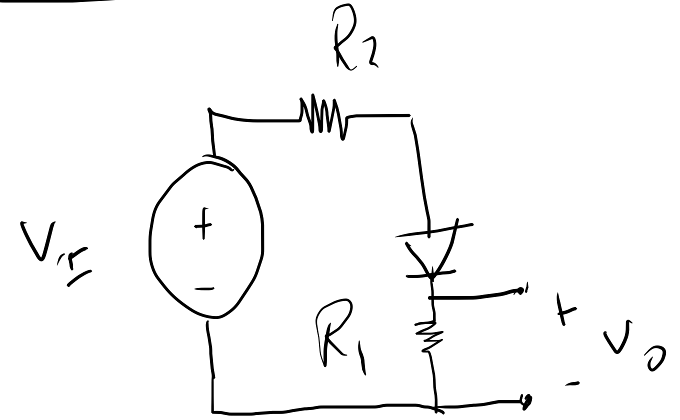
DIODES

1.



Assume Ideal Diode

a) Determine $v_o(v_I)$ - sketch it.

b) $v_I(t) = A\cos(\omega t + \phi)$

$v_o(t) = ?$ Plot $v_o(t)$

c) Compute output impedance

" input "

d) What happens if a capacitor is used as load? Plot $v_o(t)$ in this case.

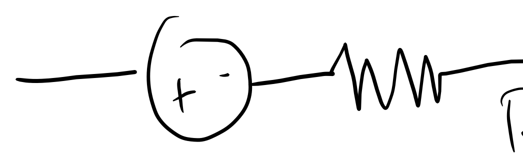
e) Compute $\frac{R_2}{R_1}$ so that the output ripple is $\frac{1}{10}$ of the input is.

Now Assume $i_D = I_S\left(e^{\frac{v_D}{2V_T}} - 1\right) = I_D + i_d$

$$v_I = V_I + v_i$$

e) Compute V_I so that $I_D = 1\,mA$

f) Compute a linear diode model for $I_D = 1\,mA$



$R_{DON} = ?$

$V_{DON} = ?$

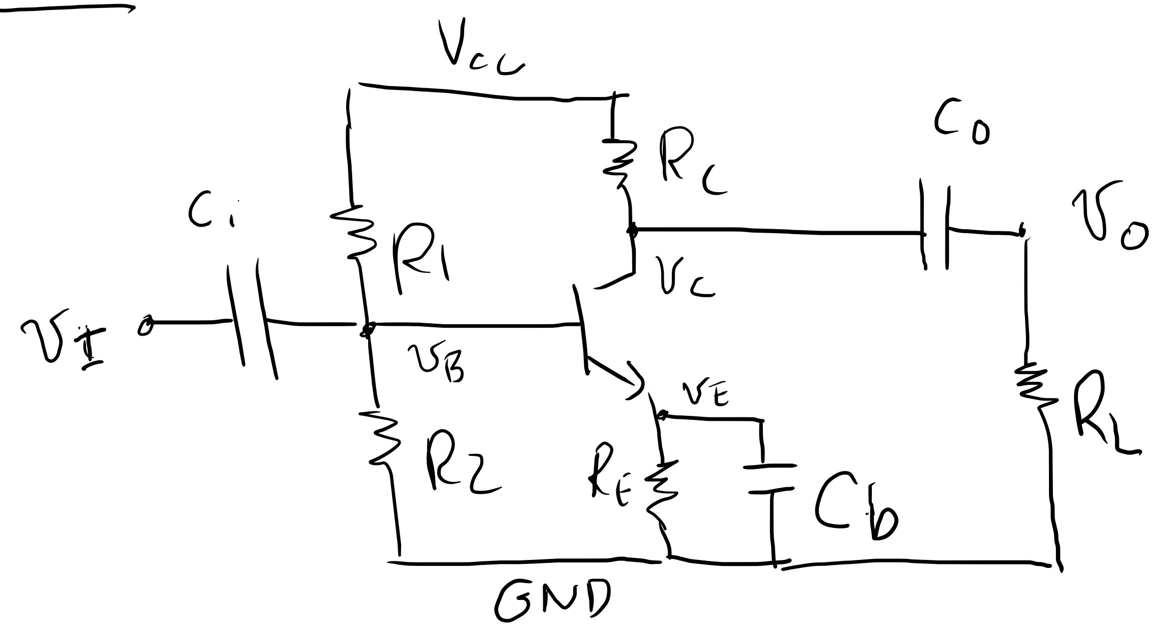
g) Compute a $\frac{|v_o|}{|v_i|}$ upper bound as a function of R_1, R_2 and R_{DON}

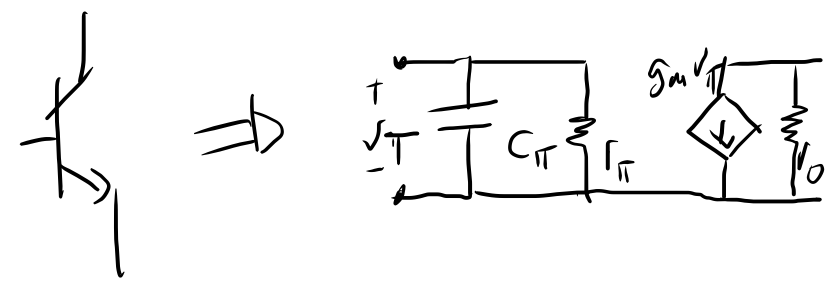
(relation between input and output ripple)

BJTs

$V_A = \infty$

$\beta_F = 100, \; C_\pi = 2pF$





$$\boxed{v_K = V_K + v_k}$$

$\Rightarrow$ Compute as a function of the circuit parameters

a) V_I, V_B, V_C, V_E, V_O (O. P.)

I_B, I_C, I_E

b) g_m, r_π, r_o (BJT's incremental parameters)

c) A_v, Z_i, Z_o for $R_L = \infty$

d) f_{low} assuming C_i and C_o can be neglected

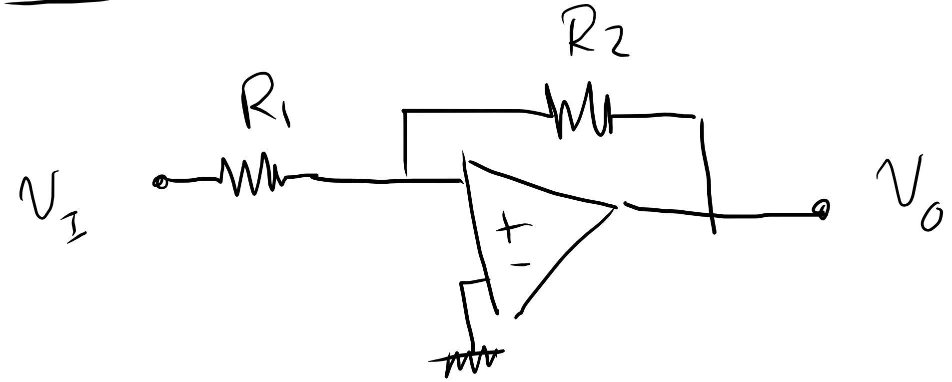
e) f_{high}

f) Explain, quantitatively, the effect of R_L on A_v, Z_i, Z_o

g) Replace C_i with a short circuit. Find the minimum and maximum value of v_I that keeps the BJT in the FAR

OP-AMPS

1.



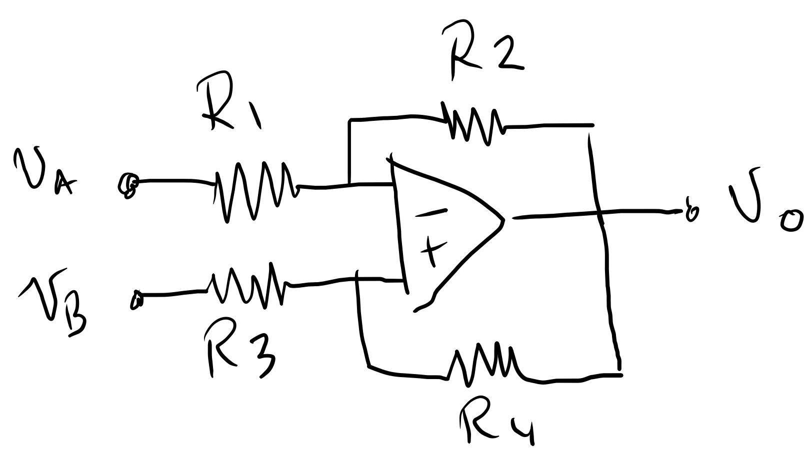
$V_{CC} = 5V$, $V_{EE} = -5V$

$v_I = A \sin(\omega t)$

$v_O(t) = ?$ Sketch the graph

! Be careful ⇒ This problem is a trap!

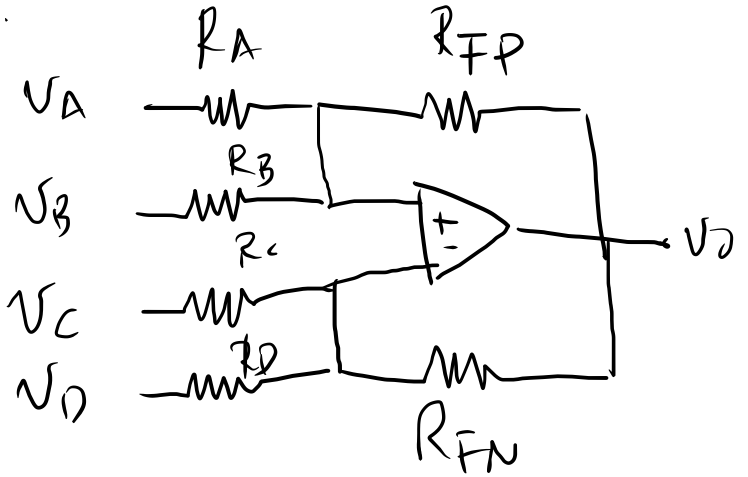
2.



Assume linear operation (negative feedback stronger than positive feedback)

Compute $v_O = v_O(v_A, v_B)$

3.



Assume linear operation

a) $v_O(v_A, v_B, v_C, v_D) = ?$

b) Replace R_A with C_A (capacitor)

〃 〃 〃 L_A (inductor)

〃 R_C 〃 C_C

〃 〃 〃 L_C

〃 R_{FP} 〃 C_{FP}

〃 〃 〃 L_{FP}

〃 R_{FN} 〃 C_{FN}

〃 〃 〃 L_{FN}

and compute $v_O(v_A, v_B, v_C, v_D)$