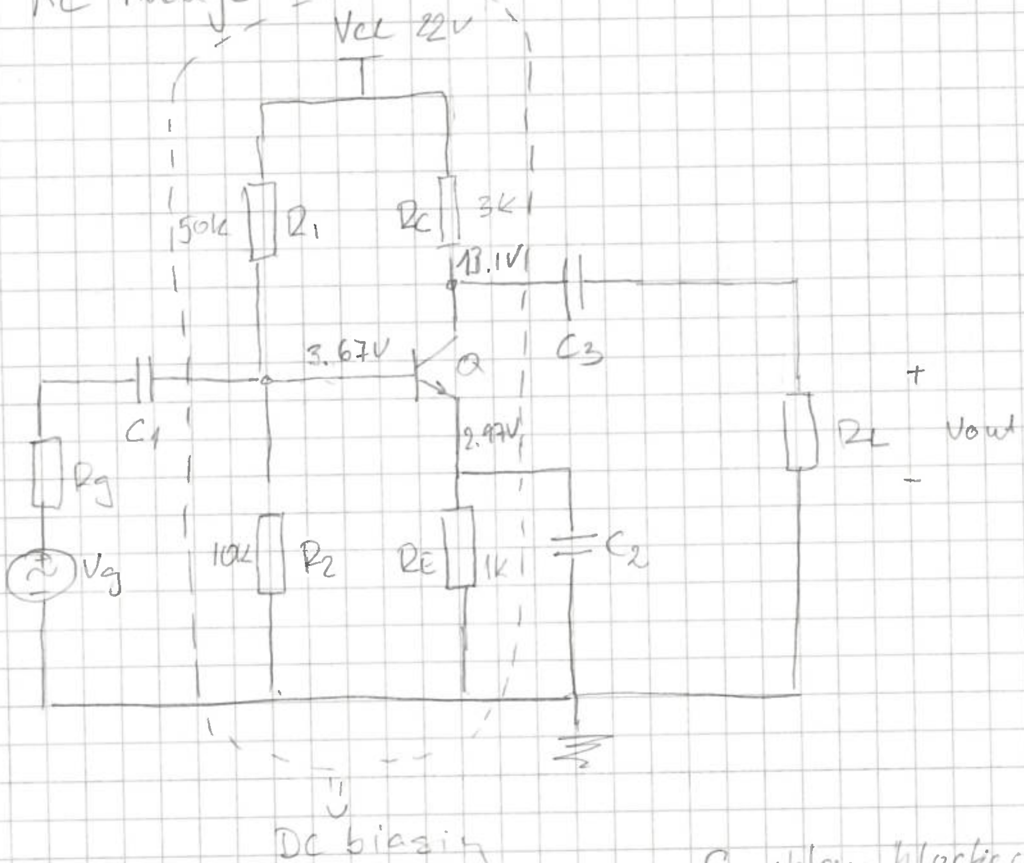
AC-Analys



DC biasing:

$I_C \approx I_A = 2.97$ mA

$V_{CE} = 10.13V$

Aktiv region

C_1 = ibland blockera DC signal

$X_C = \frac{1}{2\pi f C} \to \infty$ reaktans

f: ø, DC = 0

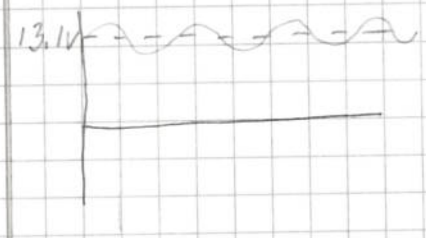
AC (at high enough f)

$X_C \to 0$

C_1 = blir kortsluten

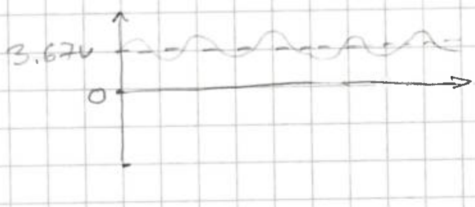
$v_C = V_C + v_c$

AC+DC DC AC



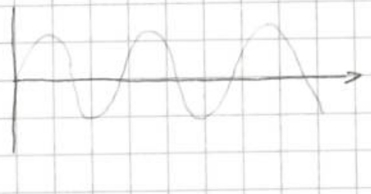
$v_B = V_B + v_b$

AC+DC DC AC



Vout (only from collector voltage)

DC blockeras i C_3



DC analys

1) short AC voltage sources

2) Replace all capacitors with opens

$$X_C = \frac{1}{2\pi f C} \rightarrow \infty$$

3) Find Q point (operations point)

AC Analisys

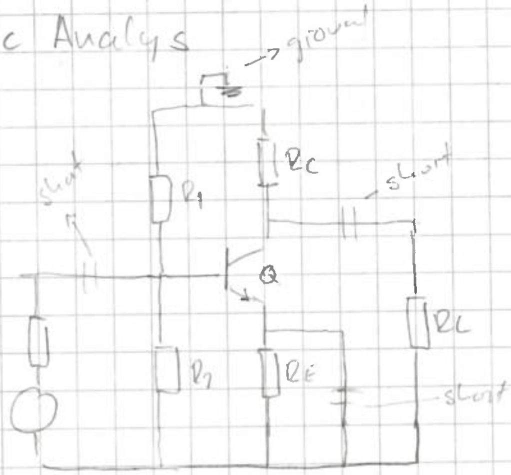
1) short DC voltage source

2) Replace all capasitor with shorts

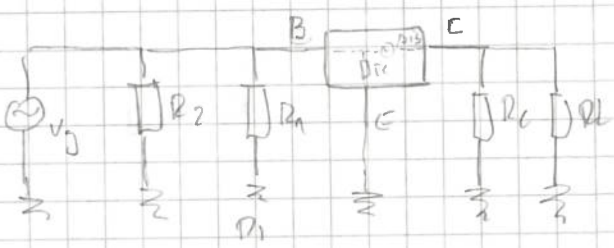
3) Simplify circuit -> combain resistors, replace transistor with model

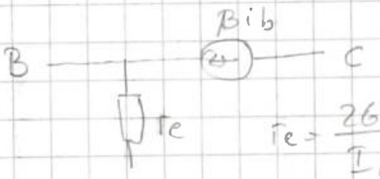
4) Finde the amplifier parameters

AC Analys



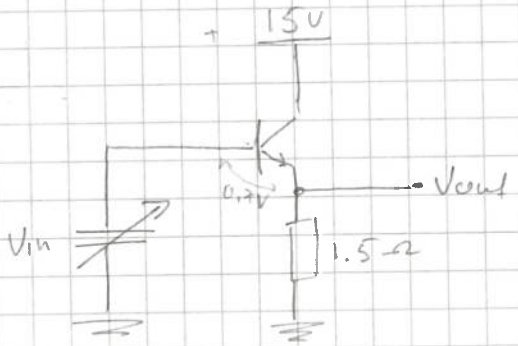
=>



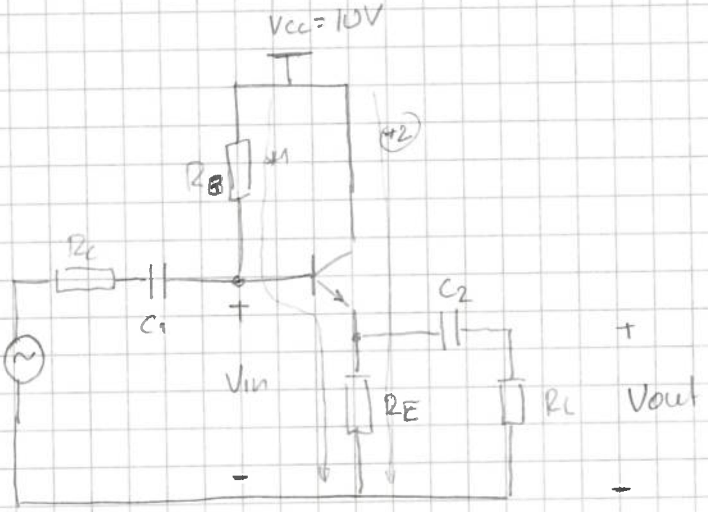


$r_e = \frac{26mV}{I_E}$ operation point on transistor

Common Collector Amplifier



Vin	Vout
0	0
0.5	0
1	0.3
1.5	0.8
2.0	1.3
5.0	4.3
8.0	7.3



DC Analysis

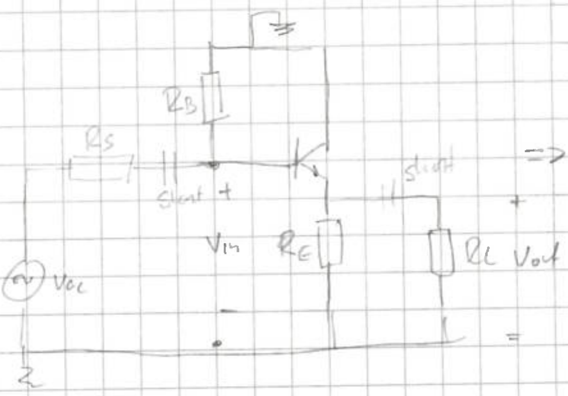
I_B, I_C, I_{CE}, I_E

(*1) $V_{CC} - I_B R_B - V_{BE} - I_E R_E = 0V$

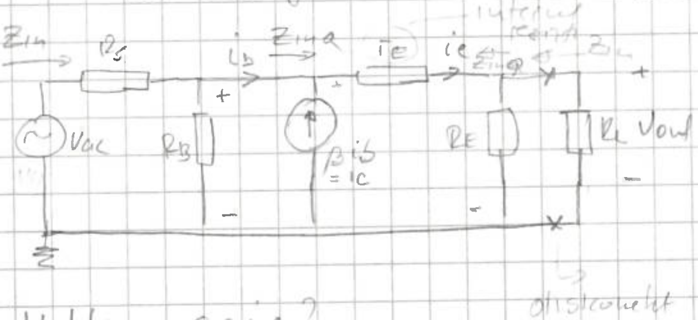
$I_E = (\beta + 1) I_B$

(*2) $V_{CC} - V_{CE} - I_E R_E = 0$

AC Analysis



Small Signal Model



Voltage gain?

l_{oad} disconnected $\Rightarrow$ $A_{VOC} = \frac{V_{out}}{V_{in}} = \frac{i_e R_E}{i_e(r_e + R_E)} = \frac{R_E}{r_e + R_E}$

$\approx$ almost 1

l_{oad} connected $\Rightarrow$ $A_V = \frac{V_{out}}{V_{in}} = \frac{i_e(R_E // R_L)}{i_e(r_e + R_E // R_L)} = \frac{R_E // R_L}{r_e + R_E // R_L}$

Input Impedance

$Z_{in} : R_B // Z_{inQ}$

$$Z_{inQ} = \frac{v_{in}}{i_{in}} = \frac{i_e(r_e + R_E // R_L)}{i_b} = \frac{(\beta+1)\cancel{i_b}(r_e + R_E // R_L)}{\cancel{i_b}}$$

$i_e = (\beta+1) i_B$ $\quad = (\beta+1)(r_e + R_E // R_L)$

$$Z_{in} = R_B // (\beta+1)(r_e + R_E // R_L)$$

$$Z_{out} = R_E // Z_{outQ}$$

$$Z_{outQ} = r_e + Z_{out\,b}$$

$$Z_{out\,b} = \frac{v_b}{i_e} = \frac{i_b(r_e // R_B)}{i_e} = \frac{i_b(R_S // R_B)}{(\beta+1)\, i_b} = \frac{R_S // R_B}{\beta+1}$$

$$Z_{out} = R_E // \left(r_e + \frac{R_S // R_B}{\beta+1}\right)$$

General: Z_{in} High
Z_{out} Low
$A_v \approx$