Aufgabe 23

a) Emitterschaltung

b) Aus: $24V = I R_L + I R_A \Rightarrow I = \frac{14}{R_L} = \frac{7}{600} \Rightarrow R_A = \frac{6000}{7}$

c) $I_C = I_L - I_A = \frac{U_L}{R_L} - \frac{U_A}{R_A} = \frac{U_B - U_{CE}}{R_L} - \frac{U_{CE}}{R_A}$

$$= \frac{U_B}{R_L} - \left(\frac{1}{R_L} + \frac{1}{R_A}\right) U_{CE}$$

$$= -2\frac{1}{k\Omega} U_{CE} + 20mA$$

d) $U_E = 2{,}5V$, $I_C = 11mA$

$11mA = -2\frac{1}{k\Omega} U_{CE} + 20mA \Rightarrow U_{CE} = 4{,}5V$

$I_B = 55\mu A$

e) $U_E = U_B + U_{BE} = I_B R_B + U_{BE} \Rightarrow R_B = \frac{U_E - U_{BE}}{I_B}$

Transistor ↓ Transistor ↓

$\Rightarrow R_B = 32{,}7 k\Omega$

g) $I_e = I_C + I_B \approx I_C$

$P = U_{CE} \cdot I_C = 4{,}5\Omega \cdot 11mA = 0{,}05 W$

Aufgabe 24

geg.: $I_A = 2mA \quad B = 200 \quad U_{BE} = 0{,}7 \quad U_{RE} = 2{,}025 V$

$U_B = 20V \quad I_{R2} = 2mA$

$I_B = \frac{I_A}{B} = 10\mu A \qquad R_E = \frac{U_{RE}}{I_{RE}} = \frac{U_{RE}}{I_A + I_B} \approx 1\Omega$

$R_2 = \frac{U_{BE} + U_{RE}}{I_{R2}} = 1{,}4 k\Omega$

$U_{R1} = R_1 \cdot I_{R1} \qquad I_{R1} = I_B + I_{R2}$

$R_1 = \frac{U_{B} - U_{R2}}{I_{R1}}$

$U_B = U_{R1} + U_{R2} \Rightarrow U_{R1} = U_B - U_{R2}$

$\Rightarrow R_1 = \frac{20V - 2mA \cdot 1{,}4 k\Omega}{10\mu A + 2mA} = 8{,}6 k\Omega$

Aufgabe 25

$u_b = 20V$, $\beta_1 = 100$, $\beta_2 = 130$, $I_{E_2} = 0,1A$

1.: $I_{E_2} = I_{RE} \cancel{R_{E_{12}}}$ $R_E = \frac{U_{RE}}{I_E} = \frac{10V}{0,1A} = 100\Omega$

2.: $I_{R_2} = 10 I_{BT_1}$

$I_{E_2} = I_{BT_2} + I_{C_2}$ $I_{C_2} = \beta_2 I_{BT_2} \Rightarrow I_{E_2} = (1+\beta_2) I_{BT_2}$

$I_{BT_2} = I_{E_1} = I_{BT_1} + I_{C_1} = (1+\beta_1) I_{BT_1} \Rightarrow I_{BT_1} = I_{E_2} \frac{1}{(1+\beta_1)(1+\beta_2)}$

$U_{R2} = U_{BE_1} + U_{BE_2} + U_{RE} = 11,3V$ $(11,4V)$

$\Rightarrow R_2 = \frac{U_{R2}}{I_{R2}} = \frac{11V}{75,6\mu A} = 149,5 k\Omega$ $\qquad I_{R1} = I_{R_2} + I_{BT_1} \approx 83,14 \mu A$

$U_{R1} = U_b - U_{R2} = 8,7V$ $\qquad \cancel{I_{R1} = I}$ Einfacher: $\qquad R_1 = \frac{U_{R1}}{I_{R1}} \approx$

$R_{Ein} = \left(\cancel{\frac{1}{R_1}} + \cancel{\frac{1}{R_2}} + \frac{1}{R_{BE_1}} + \frac{1}{R_{BE_2}} \right)^{-1}$ $\qquad$ $r_{Ein} = (1+\beta_{Ges}) R_E$ $\qquad 105 k\Omega$

$\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad \beta_{Ges} = \beta_1 \cdot \beta_2$

$R_{BE_2} = \frac{U_{BE}}{I_{E_2}} = 6,5\Omega$ $\qquad I_{E_1} = \frac{I_{E_2}}{\beta_2} = 0,76 mA$

$R_{BE_1} = \frac{U_{BE}}{I_{E_1}} = 855,26\Omega$

$R_E = 1,3 M\Omega$

$f_g = \frac{1}{2\pi RC} \Leftrightarrow \frac{1}{2\pi R f_g} = C$

$r_{par} = \frac{R_1 R_2 r_{ein}}{r_{ein}(R_1+R_2) + R_1 R_2} \approx 60\Omega$