geg.: $U_B := 12\,\text{V}$, $P_{O2} := 1.2\,\text{W}$, $\eta := 0.3$, $U_T := 0.026\,\text{V}$, $f := 14000000\,\text{Hz}$, $R_L := 50\,\text{Ohm}$

1.) Calculate Stage 2:

a) Calculate Voltages:

$$U_{RE2} := 0.1 \cdot U_B = 1.2\text{V}$$

$$U_{BE2} := 0.7\ \text{V}$$

b) Calculate bias currents: $\qquad \beta_{DC2} := 180$

$$I_{C2} := \frac{P_{O2}}{\eta} \cdot \frac{1}{U_B} = 0.333\,\text{A}$$

$$I_{B2} := \frac{I_{C2}}{\beta_{DC2}} = 0.001852\ \text{A}$$

$$I_{Q2} := 5 \cdot I_{B2} = 0.009259\,\text{A}$$

c) Calculate resistors:

$$R_{C2} := \frac{\left(U_B - U_{RE2}\right)^2}{2 \cdot P_{O2}} = 48.6 \qquad \text{Ohm}$$

$$R_{E2} := \frac{U_{RE2}}{I_{C2}} = 3.6 \quad \text{Ohm} \qquad\qquad R_{E2} := 3.3 \quad \text{Ohm}$$

$$R_{12} := \frac{U_B - U_{BE2} - U_{RE2}}{I_{B2} + I_{Q2}} = 909 \qquad \text{Ohm} \qquad R_{12} := 1000\ \text{Ohm}$$

$$R_{22} := \frac{U_{BE2} + U_{RE2}}{I_{Q2}} = 205.2 \qquad \text{Ohm} \qquad R_{22} := 220 \quad \text{Ohm}$$

d) Calculate gain resistor: $G_{dB2} := 12 \quad = 15.85$

$$R_{E2'} := \frac{R_{C2}}{10^{\frac{G_{dB2}}{10}}} = 3.066 \quad \text{Ohm}$$

$$R_{Ex2} := \frac{1}{\frac{1}{R_{E2'}} - \frac{1}{R_{E2}}} = 43.329 \qquad R_{Ex2} := 43 \quad \text{Ohm}$$

e) Calculate input resistance: $f_{T2} := 200000000$ Hz

$$\beta_{AC2} := \frac{f_{T2}}{f} = 14.286 \qquad r_{e2} := \frac{U_T}{I_{C2}} = 0.078 \quad \text{Ohm}$$

$$R_{IN2} := \frac{1}{\frac{1}{R_{12}} + \frac{1}{R_{22}} + \frac{1}{\beta_{AC2} \cdot (r_{e2} + R_{E2'})}} = 35.962 \quad \text{Ohm}$$

2.) Calculate Stage 1:

a) Calculate Voltages:

$U_{RE1} := 0.1 \cdot U_B = 1.2 \text{V}$

$U_{BE1} := 0.7 \text{ V}$

b) Calculate bias currents: $\beta_{DC1} := 210$

$$P_{O1} := \frac{P_{O2}}{10^{\frac{G_{dB2}}{10}}} = 0.076 \quad \text{W}$$

$$I_{C1} := \frac{P_{O1}}{\eta} \cdot \frac{1}{U_B} = 0.021 \text{A}$$

$$I_{B1} := \frac{I_{C1}}{\beta_{DC1}} = 0.0001 \quad \text{A}$$

$$I_{Q1} := 6 \cdot I_{B1} = 0.000601 \text{A}$$

c) Calculate resistors:

$$R_{C1} := \frac{\left(U_B - U_{RE1}\right)^2}{2 \cdot P_{O1}} = 770.258 \quad \text{Ohm}$$

$$R_{E1} := \frac{U_{RE1}}{I_{C1}} = 57.056 \quad \text{Ohm} \qquad\qquad R_{E1} := 56 \quad \text{Ohm}$$

$$R_{11} := \frac{U_B - U_{BE1} - U_{RE1}}{I_{B1} + I_{Q1}} = 14406.679 \ \text{Ohm} \qquad R_{11} := 15000 \quad \text{Ohm}$$

$$R_{21} := \frac{U_{BE1} + U_{RE1}}{I_{Q1}} = 3161.862 \quad \text{Ohm} \qquad R_{21} := 3300 \ \text{Ohm}$$

d) Calculate gain resistor: $\qquad G_{dB1} := 20 \quad = 100$

$$R_{E1'} := \frac{R_{C1}}{10^{\frac{G_{dB1}}{10}}} = 7.703 \qquad \text{Ohm}$$

$$R_{Ex1} := \frac{1}{\dfrac{1}{R_{E1'}} - \dfrac{1}{R_{E1}}} = 8.931 \qquad\qquad R_{Ex1} := 8.5 \ \text{Ohm}$$

e) Calculate input resistance: $\qquad f_{T1} := 300000000 \ \text{Hz}$

$$\beta_{AC1} := \frac{f_{T1}}{f} = 21.429 \qquad\qquad r_{e1} := \frac{U_T}{I_{C1}} = 1.236 \qquad \text{Ohm}$$

$$R_{IN1} := \frac{1}{\dfrac{1}{R_{11}} + \dfrac{1}{R_{21}} + \dfrac{1}{\beta_{AC1} \cdot \left(r_{e1} + R_{E1'}\right)}} = 178.879 \qquad \text{Ohm}$$

3.) Calculate Transformer:

a) Stage 1 output transformer:

$Z_P := R_{C1} = 770.258$ Ohm $Z_S := R_{IN2} = 35.962$ Ohm

$\ddot{u}_1 := \sqrt{\dfrac{Z_P}{Z_S}} = 4.628$

--> Guideline: 6T:28T @ FT37-43 Toroid Core
--> $L_P := 113.4 \cdot 10^{-6}$ H @ FT37-43 Toroid Core
--> $L_S := 5.6 \cdot 10^{-6}$ H @ FT37-43 Toroid Core

$\ddot{u}_{dB1} := 10 \cdot \log(\ddot{u}_1) = 6.654$ dB   --> 6.654dB loss!

$Z_P := Z_S \cdot \left(\dfrac{18}{4}\right)^2 = 728.237$ Ohm

Requirement:

$X_{LP} := 2 \cdot \pi \cdot f \cdot L_P = 9975.185$ Ohm > $10 \cdot R_{C1} = 7702.581$ Ohm --> correct!

$X_{LS} := 2 \cdot \pi \cdot f \cdot L_S = 492.602$ Ohm > $10 \cdot R_{IN2} = 359.623$ Ohm --> correct!

b) Stage 2 output transformer:

$Z_P := R_{C2} = 48.6$ Ohm $Z_S := R_L = 50$ Ohm

$\ddot{u}_2 := \sqrt{\dfrac{Z_P}{Z_S}} = 0.986$

--> Guideline: 6T:28T @ FT37-43 Toroid Core
--> $L_P := 8.75 \cdot 10^{-6}$ H @ FT37-43 Toroid Core
--> $L_S := 8.75 \cdot 10^{-6}$ H @ FT37-43 Toroid Core

$\ddot{u}_{dB2} := 10 \cdot \log(\ddot{u}_2) = -0.062$ dB   --> 0.062dB gain!

$Z_P := Z_S \cdot \left(\dfrac{5}{5}\right)^2 = 50$ Ohm

Requirement:

$X_{LP} := 2 \cdot \pi \cdot f \cdot L_P = 769.69$ Ohm > $10 \cdot R_{C2} = 486$ Ohm --> correct!

$X_{LS} := 2 \cdot \pi \cdot f \cdot L_S = 769.69$ Ohm > $10 \cdot R_L = 500$ Ohm --> correct!

4.) Gain of Driver Amplifier:

$G_{ges} := G_{dB1} - \ddot{u}_{dB1} + G_{dB2} - \ddot{u}_{dB2} = 25.408$