given: $U_B := 12$ V, $I_C := 0.0033$ A, $\beta_{DC} := 210$ @ 5mA, $U_{BE} := 0.6$ V, $f := 14000000$ Hz
$U_T := 0.028$ V @ 5mA, $R_L := 1500$ Ohm, $f_T := 300000000$ Hz

1.) Calculate Bias Voltages:

$U_{RC} := 0.413 \cdot U_B = 4.956$ V

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

$U_{CE} := U_B - U_{RE} - U_{RC} = 5.844$ V

2.) Calculate R_E:

$R_E := \dfrac{U_{RE}}{I_C} = 363.636$ Ohm = 360Ohm

3.) Calculate I_B & I_q:

$I_B := \dfrac{I_C}{\beta_{DC}} = 0.0000157$ A = 15.7uA $\qquad$ $I_q := 10 \cdot I_B = 0.000157$ A = 157uA

4.) Calculate Bias Resistors:

$R_1 := \dfrac{U_B - U_{RE} - U_{BE}}{I_q + I_B} = 59008.264$ Ohm = 62k

$R_2 := \dfrac{U_{RE} + U_{BE}}{I_q} = 11454.545$Ohm = 12k

5.) Calculate Z_{IN}:

$R_{E1} := 300$ Ohm $\qquad$ $R_{E2} := 100$ Ohm variable --> 56...1056Ohm

$r_E := \dfrac{U_T}{I_C} = 8.485$ Ohm $\qquad$ $\beta_{AC} := \dfrac{f_T}{f} = 21.429$ $\qquad$ $R_{EV} := \dfrac{R_{E1} \cdot R_{E2}}{R_{E1} + R_{E2}}$

$Z_{IN} := \dfrac{1}{\dfrac{1}{R_1} + \dfrac{1}{R_2} + \dfrac{1}{\beta_{AC} \cdot \left(r_E + R_{EV}\right)}} = 1507.768$ Ohm $\qquad$ Z_{IN} = 1061...3300Ohm

Z_{IN} **= 1.5k @** R_{E2} **= 100Ohm -->** V_U **= 9 (Simulation) --> perfect conditions**

R_{E1} and R_{E2} are calculated in 9.). $\qquad$ $\text{clear}\left(R_{E1}, R_{E2}, R_{EV}\right)$

6.) Calculate Input Transformer:

$Z_P := 750$Ohm $Z_{IN} = 1507.768$ Ohm

$\ddot{u} := \sqrt{\frac{Z_{IN}}{Z_P}} = 1.418$ --> Guideline: 5T:7T @ FT37-43 Toroid Core
--> $L := 8.75 \cdot 10^{-6}$ H @ FT37-43 Toroid Core

$Z_S := Z_P \cdot \left(\frac{7}{5}\right)^2 = 1470$ Ohm

Requirement: $X_L > 5 \cdot 50$Ohm --> $X_L > 250$ Ohm

$X_L := 2 \cdot \pi \cdot f \cdot L = 769.69$ Ohm > 250 Ohm --> correct!

7.) Calculate Z_{OUT}:

$R_C := \frac{U_{RC}}{I_C} = 1501.818$ Ohm

8.) Calculate Output Transformer:

No Transformer needed --> input impedance of SA612/MC1496 equals 1.5k

9.) Calculate V_U & R_{EV}:

Split up R_E in two parallel resistors R_{E1} & R_{E2} --> precise V_U

$$R_{EV} = \frac{R_{E1} \cdot R_{E2}}{R_{E1} + R_{E2}}$$

$V_U := 10$:

$V_U = \frac{R_C}{R_{EV}} \xrightarrow{solve, R_{EV}} 150.18181818181818$ Ohm = 150Ohm

$V_U := 5$:

$V_U = \frac{R_C}{R_{EV}} \xrightarrow{solve, R_{EV}} 300.36363636363636$ Ohm = 300Ohm

Simulation: $R_{E1} = 300$ Ohm --> I_C = 3.3mA, R_{E2} = 56...1056Ohm --> V_U = 13...3 @ R_L

10.) Calculate Lower Cut-Off Frequency:

$C_{IN} := 0.0000001$ F = 100nF $C_{OUT} := C_{IN}$ $C_E := C_{IN} \cdot 10$ $R_{E1} := 200$

$$r_{BE} := \frac{U_T}{I_B} = 1781.818$$ Ohm

$$f_{GLI} := \frac{1}{\left(2 \cdot \pi \cdot \left(Z_P \cdot r_{BE}\right) \cdot C_{IN}\right)} = 1.191$$ Hz ... Input Cut Off Frequency

$$f_{GLO} := \frac{1}{\left(2 \cdot \pi \cdot \left(R_C + R_L\right) \cdot C_{OUT}\right)} = 530.195$$ Hz ... Output Cut Off Frequency

$$f_{GLE} := \frac{1}{\left(2 \cdot \pi \cdot \left(Z_P + r_{BE} + R_{E1} \cdot \left(\beta_{DC} + 1\right)\right) \cdot C_E\right)} = 3.558$$ Hz

... Emitter Cut Off Frequency

The lowest cut off frequency determines the lower cut off frequency of the amplifier!