Literature:

Frequency response: p 679-706 p716-740

Nonlinearity: the book does not adequately support this topic, which is why the notes, accessible from the course page, are the only literature.

Assignments:

9.1:

Use the short-circuit time constant method to determine the capacitor values of C_1, C_2 and C_3, so that $f_L = 100$ Hz can be achieved for the circuit in Fig. 1. Where $g_m = 3.82 \cdot 10^{-2}$, $\beta = 301$.

Hint: $r_\pi = \beta / g_m$, $r_e = 1/g_m$.

(1) C_1, C_2 and C_3 = ?
(2) Run the LTspice simulation to check your calculation by comparing with the simulated f_L.
(3) Run the LTspice simulation to find the f_H.
(4) Run the LTspice simulation to observe harmonic distortion.

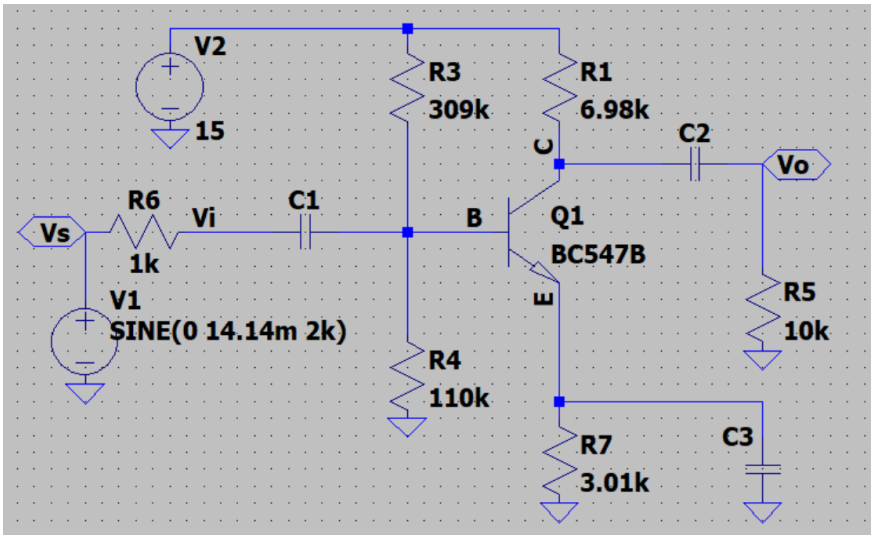


Fig. 1 A CE stage

Solution:

(1)

$f_{C_1} = f_{C_2} = 0.1f_L$= 10 Hz

$f_{C_E} = 0.8f_L = 80$ Hz

$r_\pi = \dfrac{\beta}{g_m} = 7.88\ K\Omega$

$R_B = R_3 || R_4 = 81.1\ K\Omega$

$R_E = R_7 = 3.01\ K\Omega$

$R_{C_1} = (R_B || r_\pi) + R_{sig} = 8.18\ K\Omega$

$R_{C_E} = R_E || \left(\dfrac{1}{g_m} + \dfrac{R_B || R_{sig}}{\beta + 1} \right) = 29.16\Omega$

$R_{C_2} = R_C + R_L = R_1 + R_5 = 16.98\ K\Omega$

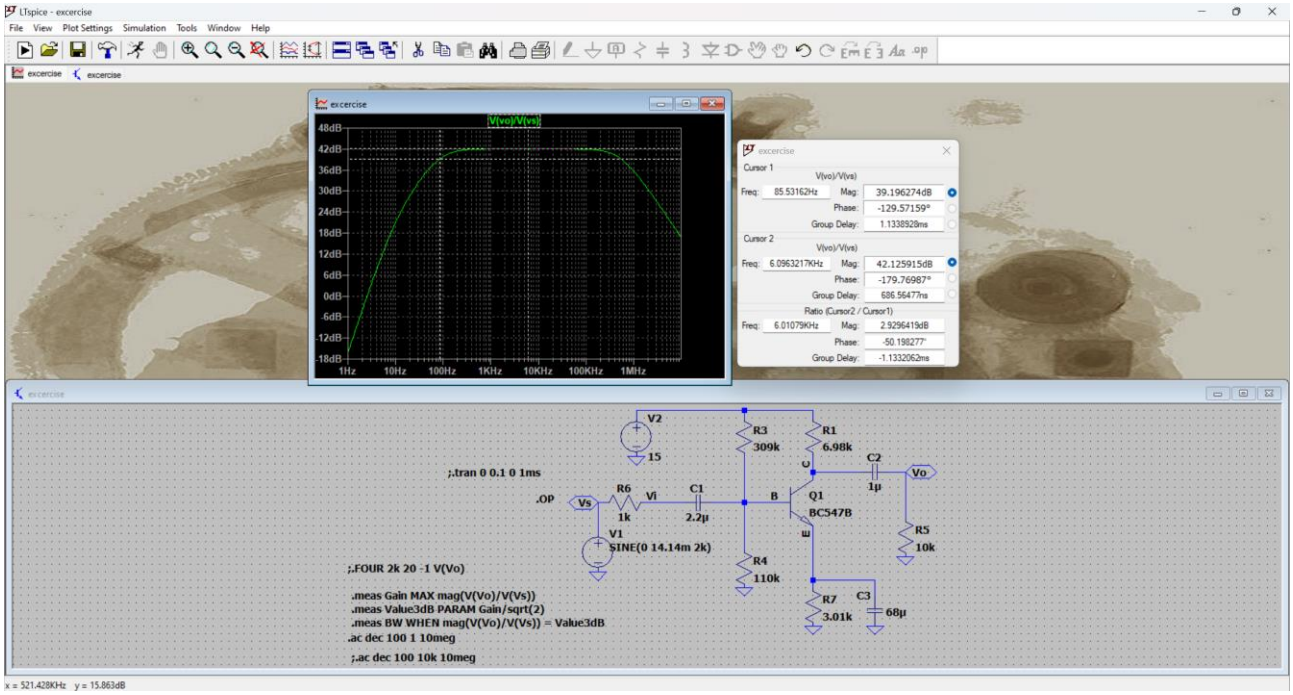
$2\pi f_{C_1} = \dfrac{1}{C_{C_1} R_{C_1}} \rightarrow C_{C_1} = \dfrac{1}{2\pi f_{C_1} R_{C_1}} = 1.94\ \mu F$

$2\pi f_{C_E} = \dfrac{1}{C_{C_E} R_{C_E}} \rightarrow C_{C_E} = \dfrac{1}{2\pi f_{C_E} R_{C_E}} = 68.2\ \mu F$

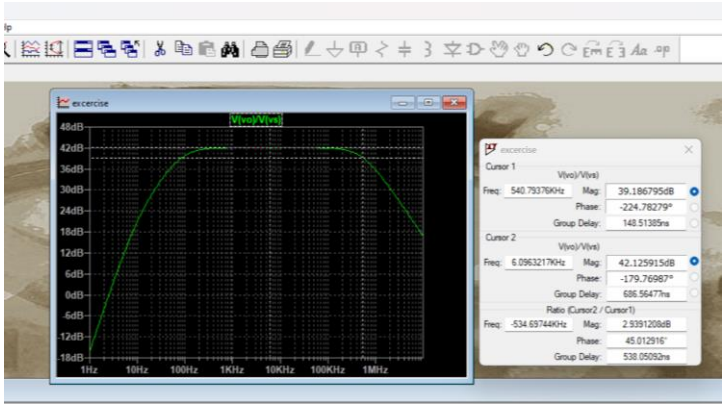
$2\pi f_{C_2} = \dfrac{1}{C_{C_2} R_{C_2}} \rightarrow C_{C_2} = \dfrac{1}{2\pi f_{C_2} R_{C_2}} = 0.94\ \mu F$

(2)

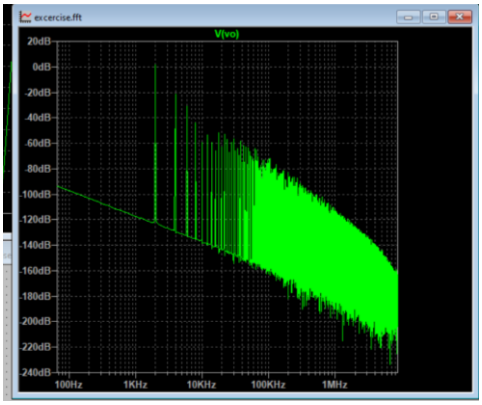
Select the standard capacitors for C_{C_1}, C_{C_E} and C_{C_2}.



(3)



(4)



Total Harmonic Distortion: 7.589737%