GTU
Electronics Engineering

ELEC 331
Electronic Circuits 2

Fall Semester

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HW 6
Questions

Updated October 20, 2017 - 13:43

Assigned:

Due:

Answers Out:

Late Due:

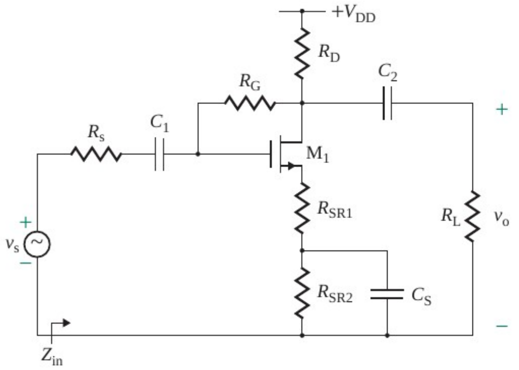
Contents

MOS Amplifier Frequency Response

7.67 Design a common-source NMOS amplifier as shown in Fig. P7.67 to give a passband gain of $20 \leq |A_{PB}| \leq 30$, $Z_{in(mid)} \geq 100$ kΩ, a low 3-dB frequency of $f_L \leq 10$ kHz, and a high 3-dB frequency of $f_H = 200$ kHz.

D P

FIGURE P7.67



Notes: Carry out only the analysis part of this question and provide the answers in terms of the parameters.

Additional Tasks: Study voltage-shunt feedback and current-series feedback.

Necessary Knowledge and Skills: Trans-conductance amplifier analysis, trans-resistance amplifier analysis, voltage-shunt feedback, feedback network analysis, effect of feedback on frequency response, MOS small signal model, SCTC, OCTC, Miller effect.

Cascaded MOS Amplifier – SCTC and OCTC

7.71 A two-stage amplifier is shown in Fig. P7.71. The parameters are $R_s = 1\ \text{k}\Omega$, $R_{11} = 500\ \text{k}\Omega$, $R_{21} = 500\ \text{k}\Omega$, $R_{D1} = 10\ \text{k}\Omega$, $R_{12} = 500\ \text{k}\Omega$, $R_{22} = 500\ \text{k}\Omega$, $R_{D2} = 15\ \text{k}\Omega$, $R_L = 10\ \text{k}\Omega$, $g_{m1} = 20\ \text{mA/V}$, $g_{m2} = 50\ \text{mA/V}$,

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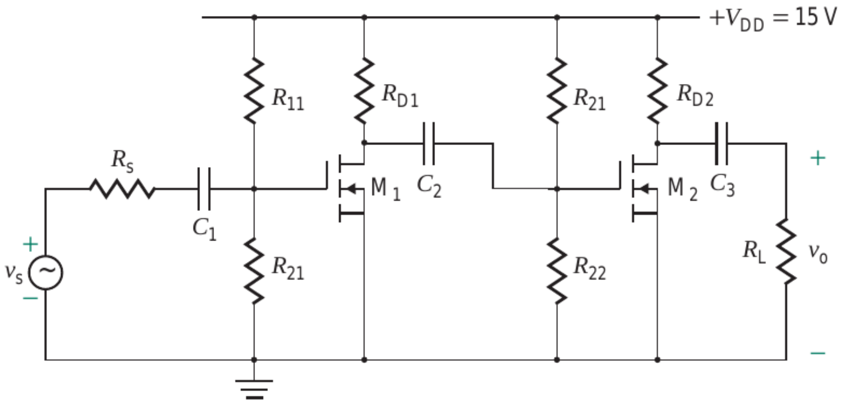
$C_1 = 1\ \mu\text{F}$, $C_2 = 1\ \mu\text{F}$, $C_3 = 10\ \mu\text{F}$, $C_{gd1} = C_{gd2} = 2\ \text{pF}$, and $C_{gs1} = C_{gs2} = 5\ \text{pF}$. Calculate the low 3-dB frequency f_L and the high cutoff frequency f_H.

FIGURE P7.71



Notes: None.

Additional Tasks: None.

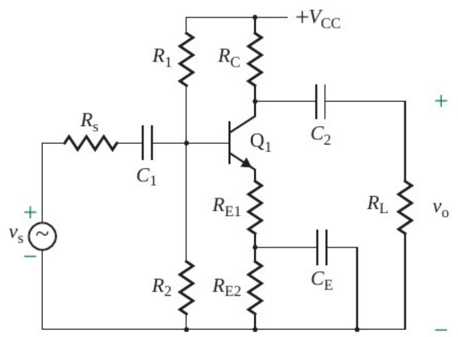
Necessary Knowledge and Skills: MOS small signal model, amplifier voltage gain computations, SCTC, OCTC, Miller's effect.

CE Amplifier Frequency Response

For Probs. 8.54–8.59 involving BJT amplifiers, use transistors whose parameters are $\beta_f = 100$, $C_{je} = 8$ pF at $V_{BE} = 0.5$ V, $C_\mu = 4$ pF at $V_{CB} = 5$ V, $C_{cs} = 4$ pF at $V_{CS} = 8$ V, $\beta_f = 100$, $V_{je} = V_{jc} = V_{js} = 0.8$ V, and $h_{oe} = 1/r_o = 5\ \mu℧$ at $V_{CE} = 10$ V. The transition frequency is $f_T = 300$ MHz at $V_{CE} = 20$ V, $I_C = 10$ mA. The substrate is connected to the ground. Assume $I_C = 5$ mA (unless specified), $V_{CC} = 15$ V, $V_{BE} = 0.7$ V, $R_s = 1$ kΩ, and $R_L = 10$ kΩ. Use PSpice/SPICE to check your design by plotting the frequency response and give an approximate cost estimate.

8.54 D P Design a CE amplifier as shown in Fig. P8.54 to give a passband gain of $40 \le |A_{PB}| \le 50$, a low 3-dB frequency of $f_L \le 1$ kHz, and a high 3-dB frequency of $f_H = 50$ kHz.

FIGURE P8.54



Notes: Analyze the circuit to compute its high and low frequency response. State your answers in terms of the parameters.

Additional Tasks: None.

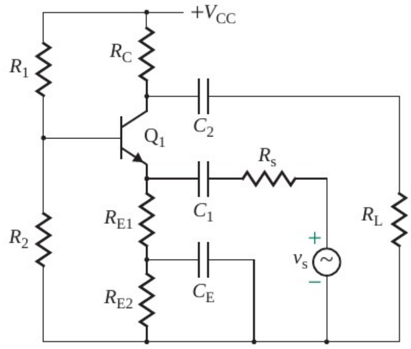
Necessary Knowledge and Skills: BJT small signal model, Miller effects, OCTC, SCTC.

CB Amplifier Frequency Response

For Probs. 8.54–8.59 involving BJT amplifiers, use transistors whose parameters are $\beta_f = 100$, $C_{je} = 8$ pF at $V_{BE} = 0.5$ V, $C_\mu = 4$ pF at $V_{CB} = 5$ V, $C_{cs} = 4$ pF at $V_{CS} = 8$ V, $\beta_f = 100$, $V_{je} = V_{jc} = V_{js} = 0.8$ V, and $h_{oe} = 1/r_o = 5$ μ℧ at $V_{CE} = 10$ V. The transition frequency is $f_T = 300$ MHz at $V_{CE} = 20$ V, $I_C = 10$ mA. The substrate is connected to the ground. Assume $I_C = 5$ mA (unless specified), $V_{CC} = 15$ V, $V_{BE} = 0.7$ V, $R_s = 1$ kΩ, and $R_L = 10$ kΩ. Use PSpice/SPICE to check your design by plotting the frequency response and give an approximate cost estimate.

8.55 D P Design a CB amplifier as shown in Fig. P8.55 to give a passband gain of $20 \le |A_{PB}| \le 30$, a low 3-dB frequency of $f_L \le 1$ kHz, and a high 3-dB frequency of $f_H = 100$ kHz. Assume $R_s = 15$ kΩ and $R_L = 10$ kΩ.

FIGURE P8.55



Notes: Analyze the circuit to compute its high and low frequency response. State your answers in terms of the parameters.

Additional Tasks: None.

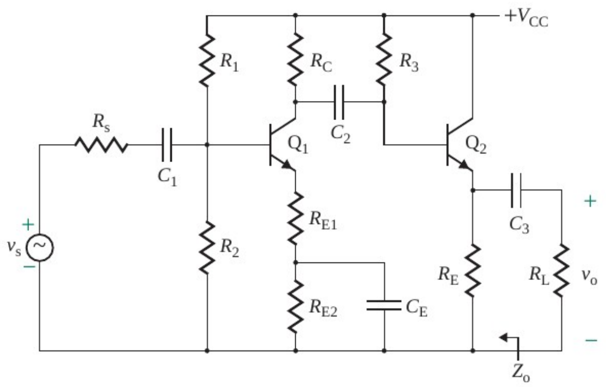
Necessary Knowledge and Skills: BJT small signal model, Miller effects, OCTC, SCTC.

Cascaded Amplifier Frequency Response

For Probs. 8.54–8.59 involving BJT amplifiers, use transistors whose parameters are $\beta_f = 100$, $C_{je} = 8$ pF at $V_{BE} = 0.5$ V, $C_\mu = 4$ pF at $V_{CB} = 5$ V, $C_{cs} = 4$ pF at $V_{CS} = 8$ V, $\beta_f = 100$, $V_{je} = V_{jc} = V_{js} = 0.8$ V, and $h_{oe} = 1/r_o = 5\ \mu℧$ at $V_{CE} = 10$ V. The transition frequency is $f_T = 300$ MHz at $V_{CE} = 20$ V, $I_C = 10$ mA. The substrate is connected to the ground. Assume $I_C = 5$ mA (unless specified), $V_{CC} = 15$ V, $V_{BE} = 0.7$ V, $R_s = 1$ kΩ, and $R_L = 10$ kΩ. Use PSpice/SPICE to check your design by plotting the frequency response and give an approximate cost estimate.

8.58 D P Design a CE-CC amplifier as shown in Fig. P8.58 to give a passband gain of $20 \le |A_{PB}| \le 30$, $Z_{i1(mid)} \le 100\ \Omega$, a low 3-dB frequency of $f_L \le 1$ kHz, and a high 3-dB frequency of $f_H = 100$ kHz.

FIGURE P8.58



Notes: Analyze the circuit to compute its high and low frequency response. State your answers in terms of the parameters.

Additional Tasks: None.

Necessary Knowledge and Skills: BJT small signal model, Miller effects, OCTC, SCTC.