Electronics II, Exam-1, Spring 2016

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March 25, 2016, Prof. Dah-Chung Chang (E1-311)

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1. (total 30 points: 5 points, 10 points, 10 points, 5 points)

For the circuit in Figure P7.21, the transistor parameters are $\beta = 120$, $V_{BE}(\text{on}) = 0.7$ V, and $V_A = 50$ V. (a) Design a bias-stable circuit such that $I_{EQ} = 1.5$ mA. (b) Using the results of part (a), find the small-signal midband voltage gain. (c) Determine the output resistance R_o. (d) What is the lower 3 dB corner frequency?

(Note: Bias-stable circuit means that $R_{th} = 0.1\times(1+\beta)R_E$.)

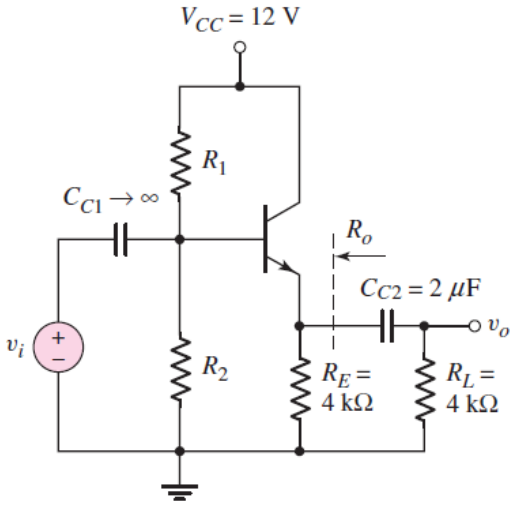

Figure P7.21

2. (total 30 points: 15 points, 15 points)

In the common-gate circuit in Figure P7.72, the transistor parameters are: $V_{TN} = 1$ V, $K_n = 3$ mA/V^2, $\lambda = 0$, $C_{gs} = 15$ pF, and $C_{gd} = 4$ pF. Determine the upper 3 dB frequency and midband voltage gain.

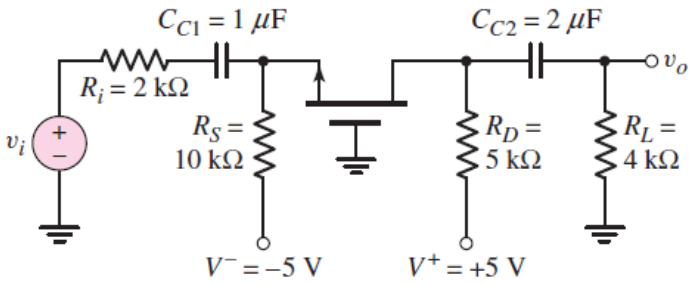

Figure P7.72

3. (total 40 points: 10 points, 10 points, 20 points)

Assume that C_{C1}, C_E, and C_{C2} acts as short circuits in this high frequency analysis.

(a) Derive the 3dB upper corner frequencies in terms of the transistor capacitors C_μ and C_π.

(b) Derive the midband voltage gain.

(c) The circuit parameters are $V^+ = 10V$, $V^- = -10V$, $R_S = 0.1k\Omega$, $R_1 = 42.5k\Omega$, $R_2 = 20.5k\Omega$, $R_3 = 28.3k\Omega$, $R_E = 5.4k\Omega$, $R_C = 5k\Omega$, and $R_L = 10k\Omega$. The transistor parameters are $\beta_o = 150$, $V_{BE(ON)} = 0.7V$, $C_\pi = 12pF$, and $C_\mu = 2pF$. Given that the quiescent collector current $I_{CQ} = 1.02\text{mA}$, determine the values of 3dB upper corner frequency for C_L acting as an open circuit and for $C_L = 15pF$.