Electronics II, Exam-1, Spring 2021

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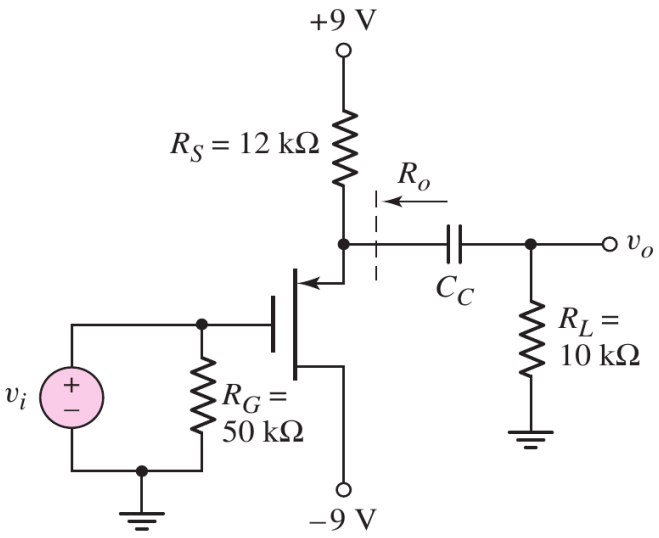
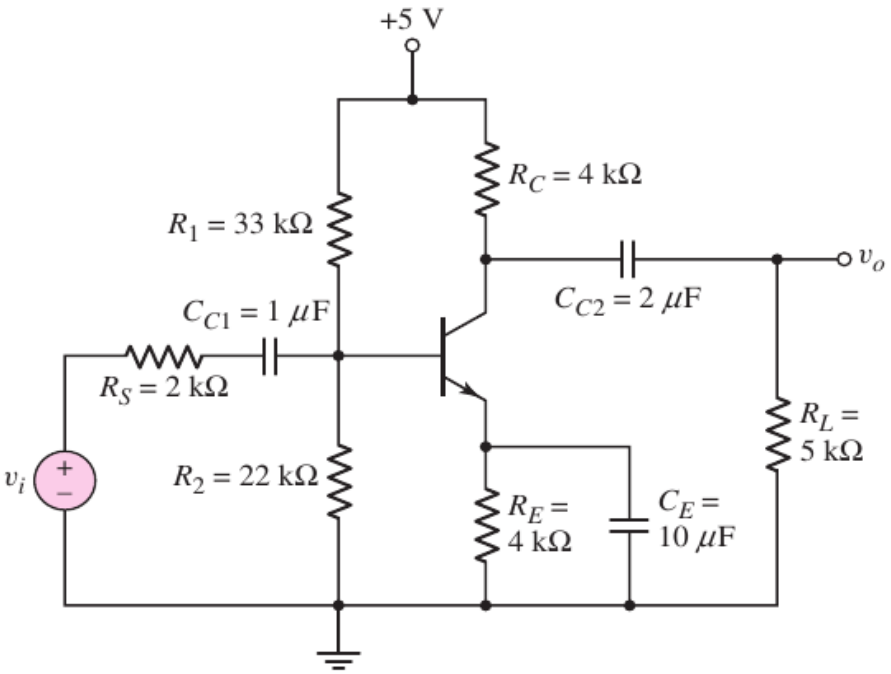
26th March, 2021, Prof. Dah-Chung Chang (E1-311)

Note: The scientific calculator is allowed in all Electronics II exams.

1. (30%) The transistor parameters are $K_p = 0.5\text{mA/V}^2$, $V_{TP} = -2\text{V}$, and $\lambda = 0$.
   (a) Determine R_o. (15%)
   (b) Determine C_C such that the lower 3 dB frequency is 20 Hz. (15%)



2. (35%) The transistor parameters are $\beta = 120, V_{BE(ON)} = 0.7\text{V}, V_A = 100\text{V}, C_\mu = 1\text{pF}$, and $f_T = 600\text{MHz}$.
   (a) Determine C_π. (15%)
   (b) Determine the upper 3dB frequency. (10%)
   (c) Determine the midband voltage gain. (10%)



3. (35%) Assume that C_{C1}, C_B, C_E, and C_{C2} act as short circuits in this high frequency analysis. Let C_L be an open circuit. The circuit parameters are $V^+ = 12\text{V}$, $V^- = 0\text{V}$, $R_S = 1\text{k}\Omega$, $R_1 = 58.8\text{k}\Omega$, $R_2 = 33.3\text{k}\Omega$, $R_3 = 7.92\text{k}\Omega$, $R_E = 0.5\text{k}\Omega$, $R_C = 7.5\text{k}\Omega$, and $R_L = 2\text{k}\Omega$. The transistor parameters are $\beta = 100$, $V_{BE(ON)} = 0.7\text{V}$, $V_A = \infty$, $C_\pi = 24\text{pF}$, and $C_\mu = 3\text{pF}$.
   (a) Neglecting base currents of transistors, determine the quiescent collector current of transistors. (5%)
   (b) Determine the 3 dB frequencies corresponding to the input and output portions of the equivalent circuit. (20%)
   (c) Calculate the small-signal midband voltage gain. (10%)