編號： 208

國立成功大學 109 學年度碩士班招生考試試題

系　　所：電機資訊學院-資訊聯招

考試科目：應用電子學

考試日期：0210，節次：2

※ 考生請注意：本試題不可使用計算機。請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

1. For an input signal, $v_i(t) = a(t) + b(t); a(t) = 0.5\sin(62832 \cdot t); b(t) = 0.8\sin(157080 \cdot t)$ where the units of v_i and t are respectively V and second. (a) What are the frequencies of $a(t)$ and $b(t)$?(4%); (b) Assuming an ideal OP-Amp was used in the circuit **Figure 1** for filtering the input signal $v_i(t)$, derive the transfer function of the circuit (8%); (c) If the circuit is a Butterworth filter derive the relation between C_3 and C_4?(6%); (d) If we want to apply the circuit such that the bandwidth is 20 kHz and let R = 100kΩ, what are values of capacitors? (6%); Plot the Bode transfer function magnitude (4%).

2. The parameters of the transistor in the circuit in **Figure 2** are β= 100, $V_{BE(on)}$ = 0.7 V, $V_A = \infty$, C_π = 10 pF, and C_μ = 1 pF. (a) Plot the equivalent circuits for the DC, low-frequency (without considering transistor capacitances), and high-frequency range (considering transistor capacitances). (12%); (b) Determine input and output impedance for the input signal at **low-frequency range** (6%); (c) Determine upper 3 dB frequencies corresponding to the input signal at **high-frequency range** (8%); Plot the Bode transfer function magnitude. (4%); (d) If a load capacitor C_L=15pF is connected between the output and ground, determine if the upper 3 dB frequency will be determined by the C_L load capacitor or by the transistor characteristics. (6%)

3. For the circuit in **Figure 3**, the transistor parameters are: V_{TN} = 1 V, K_N = 3 mA/V^2, λ = 0, C_{gs} = 15 pF, and C_{gd} = 4 pF. (a). Plot the equivalent circuits for the DC, low-frequency (without considering transistor capacitances), and high-frequency range (considering transistor capacitances). (12%); (b). Determine the midband voltage gain (6%) and 3dB frequency for the input signal at **low-frequency** range (6%); (c). Determine the upper 3 dB frequency (6%) and midband voltage gain (6%) for the input signal at **high-frequency** range.

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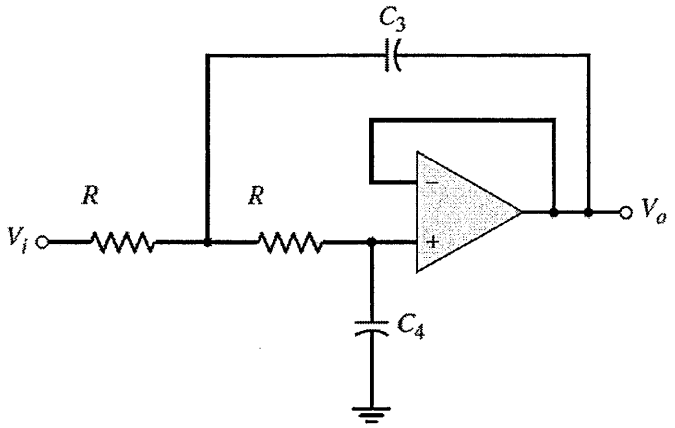

Figure 1.

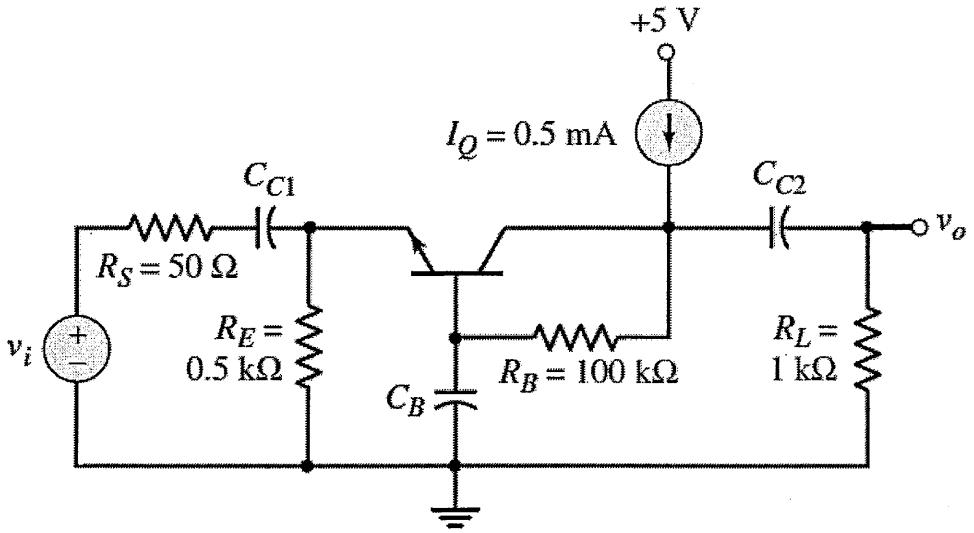

Figure 2.

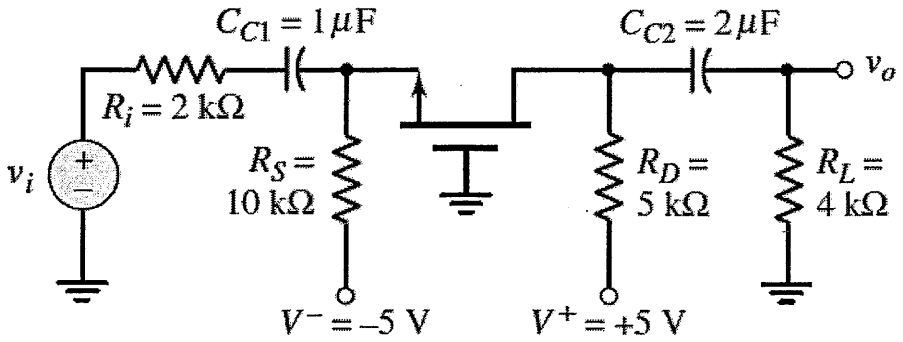

Figure 3.