

國立臺灣師範大學 104 學年度碩士班招生考試試題

科目：電子學

適用系所：電機工程學系

注意：1.本試題共 3 頁，請依序在答案卷上作答，並標明題號，不必抄題。2.答案必須寫在指定作答區內，否則不予計分。

1. (10 points) The circuit shown in Fig. 1 is intended to supply a voltage to floating loads. Assuming ideal op amps, find the voltage gain v_o/v_i .

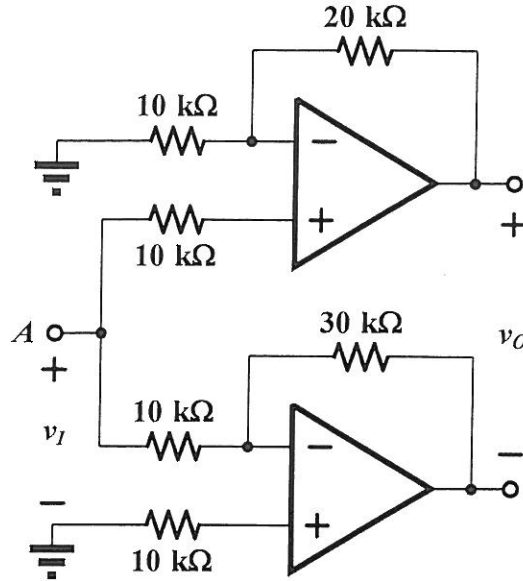


Fig. 1

2. (20 points) The NMOS transistor in the circuit of Fig. 2 has $\mu_n C_{ox} = 100 \mu\text{A}/\text{V}^2$, $W = 32 \mu\text{m}$, $L = 1 \mu\text{m}$, and $V_t = 1 \text{ V}$. Neglect the channel-length modulation effect (i.e., assume $\lambda = 0$). Find
- the overdrive voltage V_{OV} .
 - the drain current I_D .
 - the drain voltage V_D .

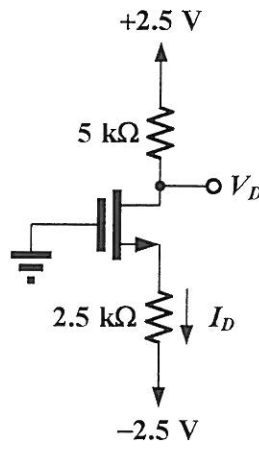


Fig. 2

國立臺灣師範大學 104 學年度碩士班招生考試試題

3. (15 points) For the CS amplifier shown in Fig. 3, a signal source v_i with an internal resistance $R_S = 200 \text{ k}\Omega$. The NMOS transistor is operated in saturation region and has $r_o = 150 \text{ k}\Omega$, $g_m = 0.2 \text{ mA/V}$, $C_{gs} = 1 \text{ pF}$, and $C_{gd} = 0.5 \text{ pF}$. Find
- the midband gain $A_M \equiv v_o/v_i$.
 - the upper 3-dB frequency f_H .
 - the appropriate value of the bypass capacitor C_S to have the lower 3-dB frequency f_L at 100 Hz.

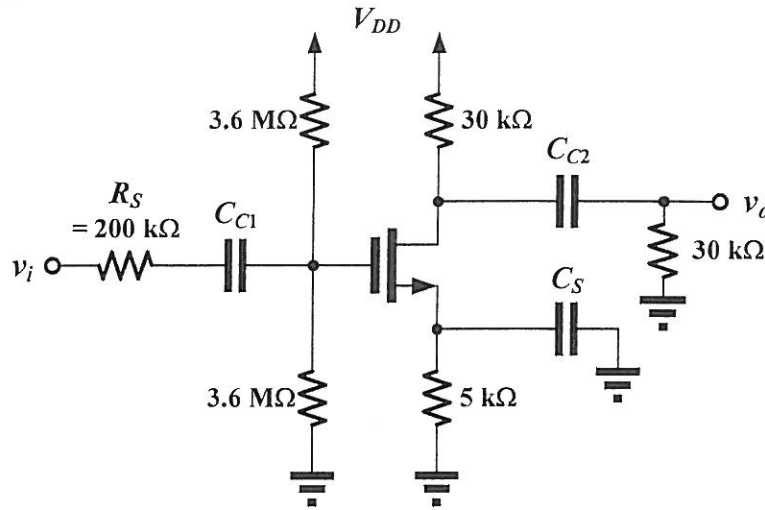


Fig. 3

4. (20 points) For the circuit of Fig. 4, the BJTs have $\beta = 100$, $|V_{BE}| = 0.7 \text{ V}$, and $|V_{CEsat}| = 0.2 \text{ V}$. Find V_B and V_E for
- $v_I = 3 \text{ V}$.
 - $v_I = -10 \text{ V}$.

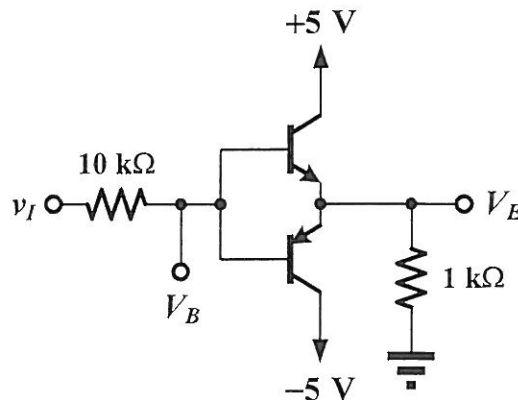


Fig. 4

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5. (20 points) For the emitter-follower circuit shown in Fig. 5, the BJT used is specified to have $\beta = 200$, $V_{BE(\text{active})} = 0.7 \text{ V}$, and $V_T = 25 \text{ mV}$. Find

- I_E , V_E , and V_B .
- the input resistance R_i .
- the signal gain v_o/v_{sig} .

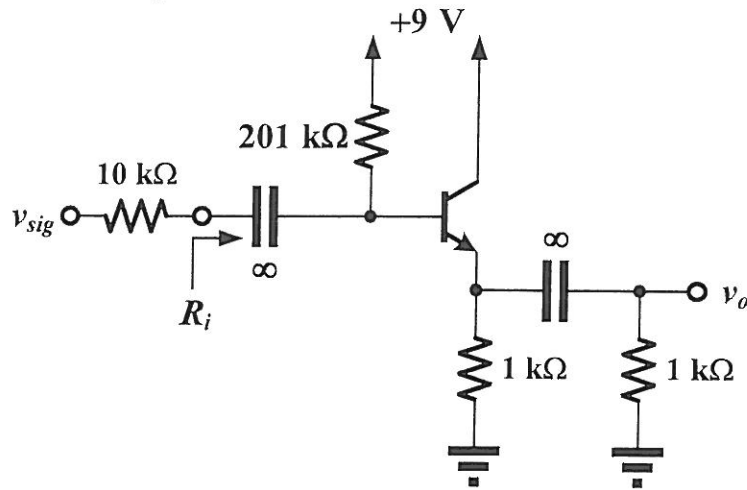


Fig. 5

6. (15 points) The voltage-to-current converter, as shown in Fig. 6, can supply the load impedance Z_L with a current i_o proportional to v_I and independent of the value of Z_L . Show that this is indeed the case by deriving the output current i_o as a function of v_I .

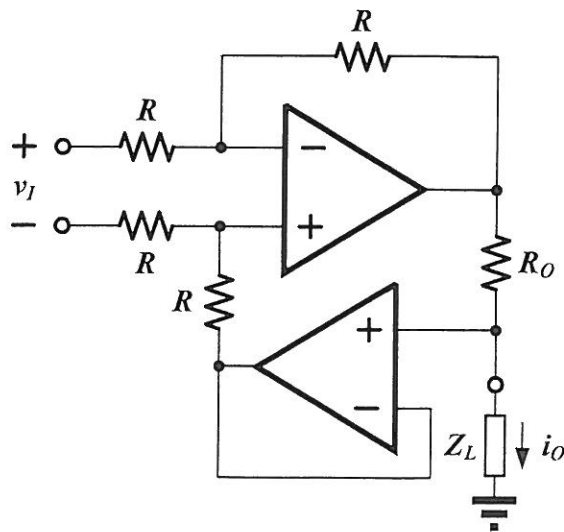


Fig. 6

