

請按題目順序，作答於答案紙

1. An NMOS amplifier is shown on Fig. 1. The NMOS has threshold voltage $V_t = 2\text{ V}$,

$$K = \frac{1}{2} \mu_n C_{ox} \left(\frac{W}{L} \right) = 0.25 \text{ mA/V}^2 \text{ and } V_A = 100 \text{ V} \quad (r_o \equiv V_A / I_D).$$

$$R_G = 10 \text{ M}\Omega.$$

(a) Find the dc bias voltage at the drain to obtain a voltage gain (v_o/v_i) of -100. (10分)

(b) Find the required bias current I . (5分)

(b) Find the input resistance of the amplifier. (5分)

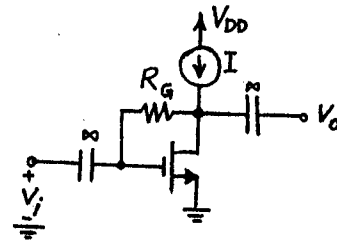


Fig. 1

2. The BJTs in the Darlington follower of Fig. 2 have $\beta_o = 100$. If $R_s = 100 \text{ k}\Omega$ and $R_L = 1 \text{ k}\Omega$, find

(a) the input resistance R_i , (7分)

(b) the output resistance R_o , (7分)

(c) the overall voltage gain v_o/v_s . (6分)

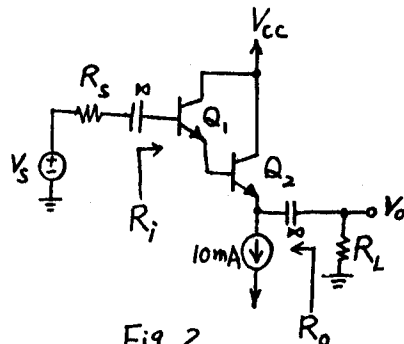


Fig. 2

3. (a) Find the frequency of oscillation of the circuit in Fig. 3(a). (10分)

(b) Find the frequency of oscillation of the circuit in Fig. 3(b). (10分)

4. A circuit is shown in Fig. 4. Using a Zener diode with a breakdown voltage of 5.6 V, design the circuit (R_1, R_2, R_3, R_4) to produce an output voltage of 10 V.

Assume the input voltage is 12 V and the Zener diode current is $I_Z = 1 \text{ mA}$.

(15分)

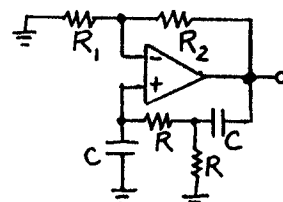


Fig. 3(a)

5. The transistor parameters for the circuit shown in Fig. 5 are $\beta = 200$, $V_{BE(on)} = 0.7 \text{ V}$, and $V_A = 80 \text{ V}$. Determine the differential-mode voltage gain $A_d = v_{o3}/v_d$. (15分)

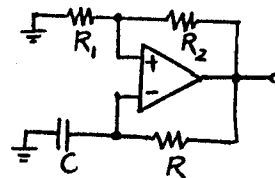


Fig. 3(b)

6. A circuit is shown in Fig. 6. Determine the current I_o when $I_s = 1 \text{ mA}$. (10分)

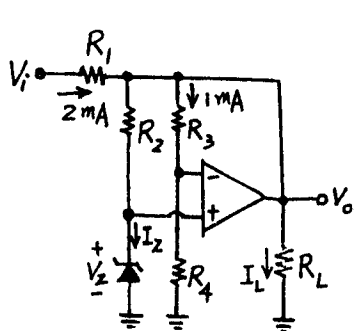


Fig. 4

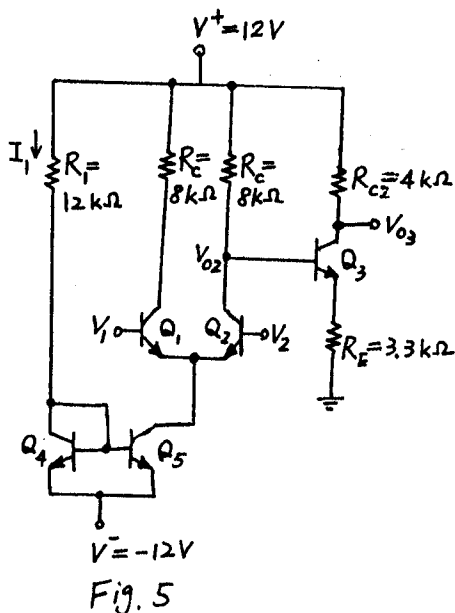


Fig. 5

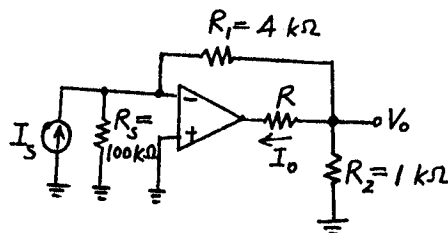


Fig. 6