南台科技大學 101 學年度研究所考試入學招生考試

系組：電機系丙組、電機系海外、光電系、生醫所　　准考證號碼：□□□□□□

科目：電子學(145)　　(請考生自行填寫)

注意事項	一、 請先檢查准考證號碼、報考系(組)別、考試科目名稱，確定無誤後再作答。 二、 所有答案應寫於答案紙上，否則不予計分。 三、 作答時應依試題題號，依序由上而下書寫，作答及未作答之題號均應抄寫。

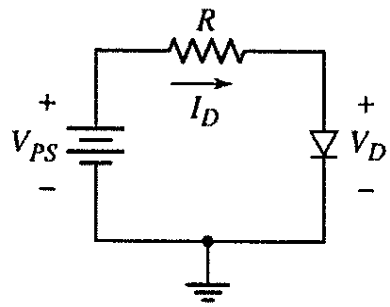
1. For the circuit in **Fig. 1**, assume that the diode has the cut-in voltage of $V_\gamma = 0.6$ V and the forward resistance of $r_f = 10\ \Omega$.

(1) If $V_{PS} = 2$ V and $R = 2$ kΩ, determine the diode voltage V_D. (5%)

(2) If $V_{PS} = 5$ V and $R = 2$ kΩ and the diode forward resistance r_f is changed to be 0 Ω, plot the diode I-V characteristics and the load line to find the Q-point (V_D and I_D). (5%)

(3) If $V_{PS} = 0.2$ V and $R = 2$ kΩ, determine the diode current I_D. (5%)

Fig. 1



2. For the circuit in **Fig. 2**, the transistor parameters are: $V_{BE(ON)} = 0.7$ V, $\beta = 100$, and $V_A = \infty$.

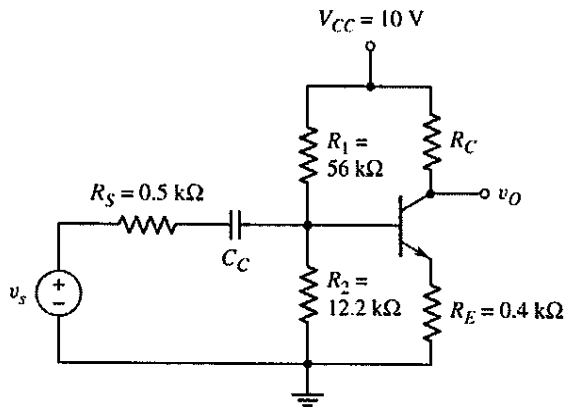
(1) If $I_{CQ} = 2.16$ mA and $V_{CEQ} = 4.81$ V, determine the value of R_C. (5%)

(2) Plot the small-signal equivalent circuit of the circuit. (5%)

(3) Determine the input resistance looking into the base of the transistor. (5%)

(4) Determine the small-signal approximate voltage gain $A_v \cong v_o / v_s$. (5%)

Fig. 2



背面有題

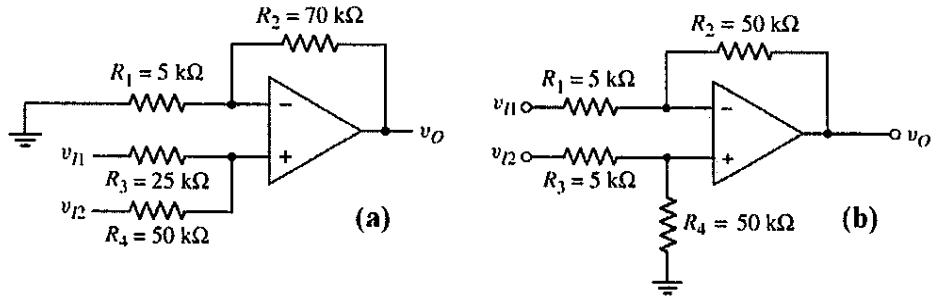
3. In **Fig. 3,** assume the op amps are ideal and let $v_{I1} = 1\,\text{V}$ and $v_{I2} = 2\,\text{V}$.

(1) Determine the output voltage v_o in **Fig. 3 (a)**. (5%)

(2) Determine the output voltage v_o in **Fig. 3 (b)**. (5%)

(3) In **Fig. 3 (b),** if R_4 is changed to be 55 kΩ, determine the CMRR (dB). (10%)

Fig. 3



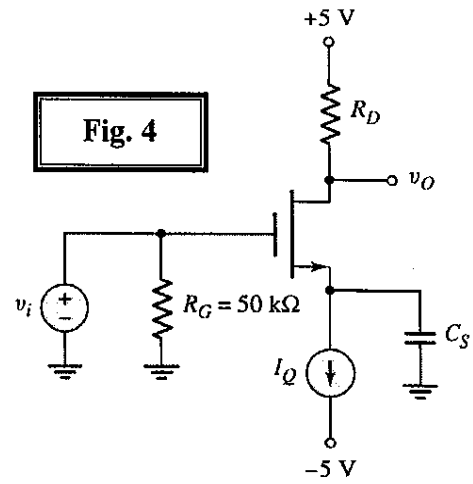
4. The circuit in **Fig. 4** has $R_D = 4\text{k}\Omega$, $I_Q = 0.5$ mA and transistor parameters $V_{TN} = 1.5$ V, $\mu_n C_{ox} = 40\mu\text{A/V}^2$, and $\lambda = 0$. If the small-signal voltage gain is $A_v = v_O / v_i = -4$,

(1) Find the transconductance g_m of the transistor. (5%)

(2) Determine the width-to-length ratio W/L of the transistor. (5%)

(3) Calculate V_{GSQ} and V_{DSQ}. (10%)

Fig. 4



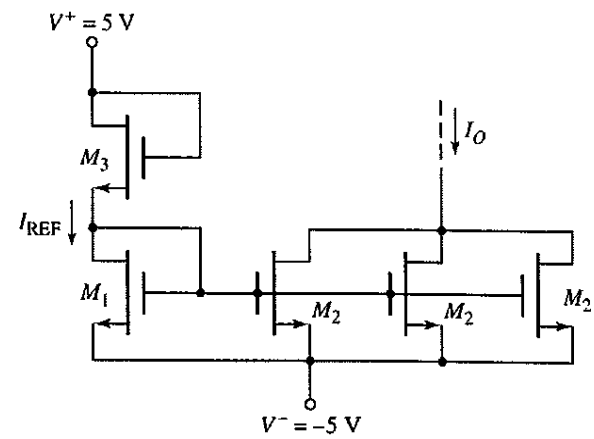
5. Consider the circuit shown in **Fig. 5**. The transistor parameters are:

$V_{TN} = 2\text{V}$, $K_{n1} = K_{n2} = 0.4\text{mA/V}^2$, $K_{n3} = 0.1\text{mA/V}^2$ and $\lambda = 0$.

All transistors labeled M_2 are identical.

Determine I_{REF} and I_O. (10%)

Fig. 5



6. Consider the circuit in **Fig. 6**, with transistor parameters: $\beta = 100$, $V_{BE(on)} = 0.7\text{V}$, and $V_A = \infty$.

(1) Show $I_{C2} = \dfrac{I_1}{1 + \dfrac{2}{\beta(1+\beta)}}$ (5%)

(2) Find I_{C4} and V_{CE4}. (10%)

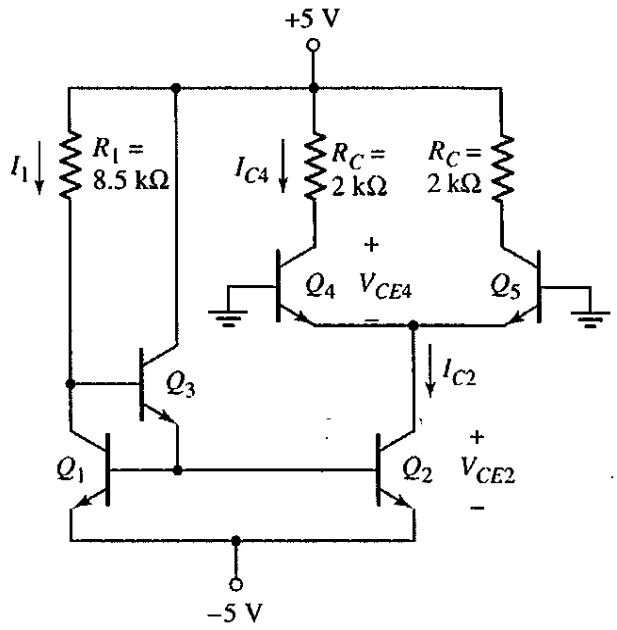


Fig. 6

 背面有題