

國立中央大學 105 學年度碩士班考試入學試題

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共 3 頁 第 1 頁

科目： 電子學

本科考試禁用計算器

*請在答案卷(卡)內作答

1. 計算題(15 分)

For the circuits given in Figure P1, the device parameters of the nMOSFET are $V_t = 1\text{ V}$, $\lambda = 0\text{ V}^{-1}$, $\gamma = 0\text{ V}^{-1}$, $\mu_n C_{ox} = 50\text{ }\mu\text{A/V}^2$, $W/L = 2.0\text{ }\mu\text{m} / 1.0\text{ }\mu\text{m}$.

1-1 (5 分) Find the output resistance R_o .

1-2 (10 分) If the circuit has a voltage gain $v_o/v_i = -2$, find the current I .

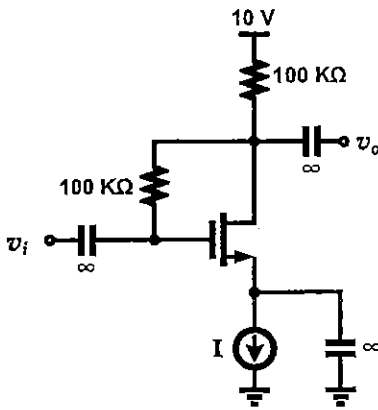


Fig. P1

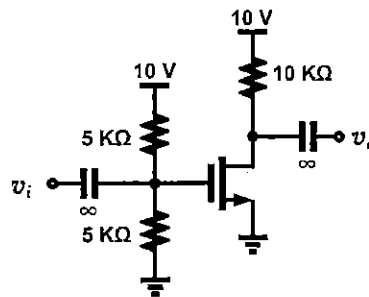


Fig. P2

2. 計算題(15 分)

For the circuits given in Figure P2, the device parameters of the nMOSFET are $V_t = 1\text{ V}$, $\lambda = 0.01\text{ V}^{-1}$, $\gamma = 0\text{ V}^{-1}$, $\mu_n C_{ox} = 50\text{ }\mu\text{A/V}^2$, $W/L = 1.0\text{ }\mu\text{m} / 1.0\text{ }\mu\text{m}$. Find

2-1 (5 分) the drain current I_D .

2-2 (10 分) the voltage gain v_o/v_i .

3. 計算題(10 分)

For the circuits given in Figure P3, if the circuit represented by its Thevenin equivalent circuit has $v_S = 7.5\text{ V}$ between the output nodes. Find,

3-1 (5 分) the value of the resistance R .

3-2 (5 分) if the circuit represented by its Norton equivalent circuit, find its current source i_S in this case.

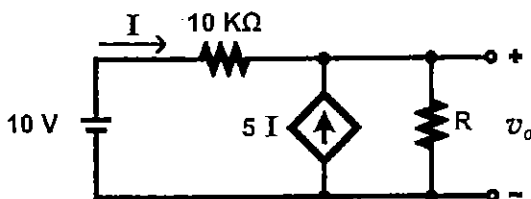


Fig. P3

注意：背面有試題

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共 3 頁 第 2 頁

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4. 計算題(10 分)

For the circuit shown in Figure P4, the current equation of the diodes are $I_D = I_S \times \exp(V_D/V_T)$ and $V_T = 0.025 \text{ V}$, $R = 25 \text{ } \Omega$, $I = 0.5 \text{ mA}$. Using the diode small-signal model to find the voltage gain v_o/v_i .

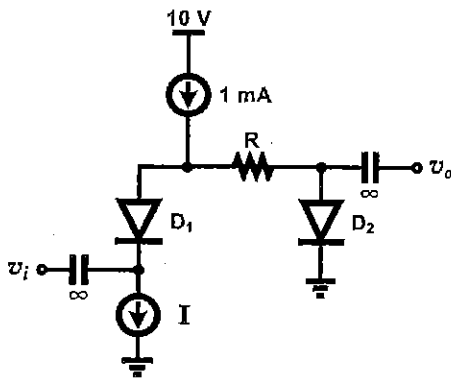


Fig. P4

5. 計算題(16 分)

Figure P5 shows a cascode MOS mirror using all devices with $V_t = 0.5 \text{ V}$, $\mu_n C_{ox} = 320 \text{ } \mu\text{A/V}^2$, $V_A' = 5 \text{ V}/\mu\text{m}$, $W/L = 3.6 \text{ } \mu\text{m}/0.36 \text{ } \mu\text{m}$, and $I_{REF} = 100 \text{ } \mu\text{A}$. Find,

5-1 (8 分) the minimum voltage required at the output.

5-2 (8 分) the output resistance R_o .

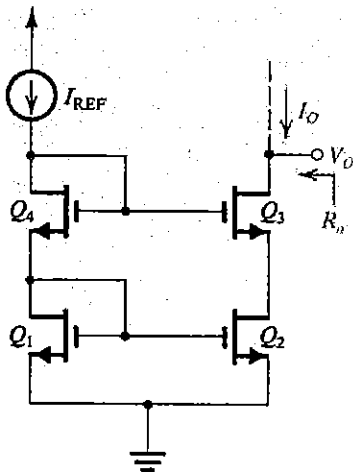


Fig. P5

注意：背面有試題

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6. 計算題(16分)

Figure P6 shows a bipolar current-mirror-loaded differential amplifier which is biased with a current source $I = 1$ mA. The transistors are specified to have Early voltage $|V_A| = 100$ V. The total capacitance at the output node is 2 pF. Please find,

6-1 (8分) the dc voltage gain.

6-2 (8分) the frequency of the dominant pole.

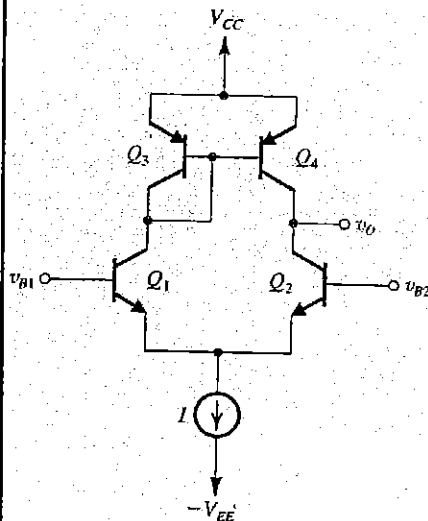


Fig. P6

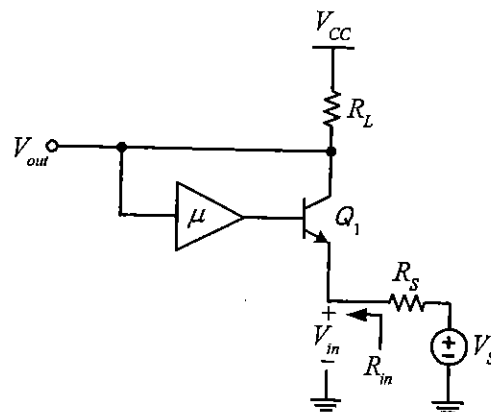


Fig. P7

7. 計算題(18分)

Figure P7 shows a common-base amplifier with a voltage-voltage feedback. The transconductance of the transistor is set as g_m . The feedback block having a gain of μ senses the output voltage and subtracts a fraction from the input. Neglect the Early effect and base current, please derive:

7-1 (8分) the input impedance R_{in} in terms of g_m , μ , and R_L .

7-2 (10分) the voltage gain V_{out}/V_s in terms of R_L , R_S , μ , and g_m .