國立成功大學
111學年度碩士班招生考試試題

編　號：129

系　所：系統及船舶機電工程學系

科　目：電子學

日　期：0219

節　次：第 2 節

備　註：可使用計算機

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

1、If, for a particular junction, the acceptor concentration is $10^{17}/cm^3$ and the donor concentration is $10^{16}/cm^3$, (a) find the junction built-in voltage. Assume n_i = 1.5 x $10^{10}/cm^3$. Also, (b) find the width of the depletion region (W) and its extent in each of the *p* and *n* regions when the junction terminals are left open. (c) Calculate the magnitude of the charge stored on either side of the junction. Assume that the junction area is 100 μm^2 (15%)

2、For the circuit in Figure 1, (a) Derive the expression for v_O in terms of v_{I1} and v_{I2}, and (b) Find v_O if v_{I1}=1+2sinωt mV and v_{I2}=-10mV. (15%)

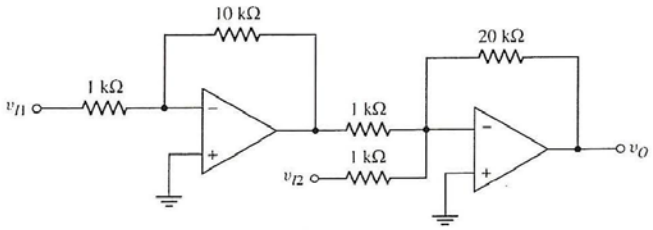

Figure 1

3、For the op-amp circuit shown in Figure 2, Determine the gain $A_v=v_O/v_I$. (15%)

4、For the devices in the circuit of Figure 3, $|V_t| = 0.5V$, $\lambda = 0$, $\mu_n C_{ox}$ = 400 $\mu A/V^2$ L=0.5μm, and W=0.5μm, Find V_2 and I_2. How do these values change if Q_3 and Q_4 are made to have W=5μm? (15%)

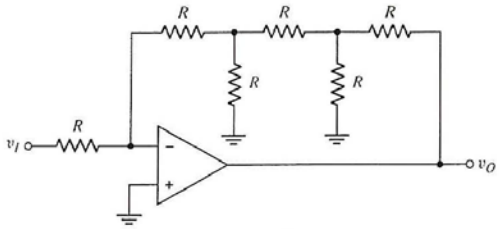

Figure 2

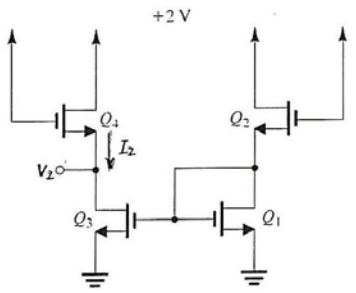

Figure 3

5、The parameters for each transistor in the circuit shown in Figure 4 are $\beta=100$ and $V_A=\infty$. (a) Determine the small-signal parameters g_m, r_π, and r_o for both transistors. (b) Determine the small-signal voltage gain $A_{v1}=v_{o1}/v_s$, assume v_{o1} is connected to an open circuit, and determine the gain $A_{v2}=v_o/v_{o1}$. (c) Determine the overall small-signal voltage gain $A_v=v_o/v_s$. Compare the overall gain with the product $A_{v1} \cdot A_{v2}$, using the values calculated in part (b). (20%)

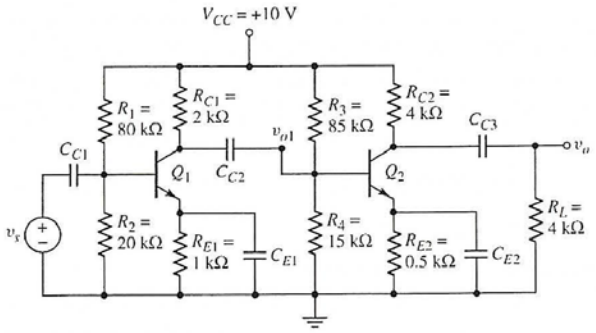

Figure 4

6、For the PMOS common-source circuit shown in Figure 5, the transistor parameters are $V_{TP}=-2V$, $K_p=1mA/V^2$, $\lambda=0$, $C_{gs}=15pF$, and $C_{gd}=3pF$. (a) What is the equivalent Miller capacitance? (b) Determine the upper 3dB frequency. (c) Find the midband voltage gain. (20%)

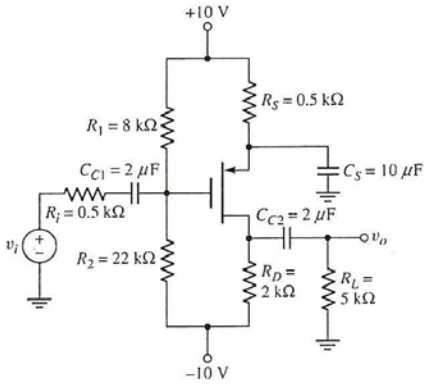

Figure 5