國立成功大學 108 學年度碩士班招生考試試題

系　　所：系統及船舶機電工程學系

考試科目：電子學

考試日期：0223，節次：2

※ 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、Consider the voltage reference circuit shown in Figure 1. Determine v_O, i_2, and i_Z.
(a) When Zener diode is in breakdown, Why ? (10%)
(b) When Zener diode is not in breakdown, Why ? (10%)

2、For the PMOS common-source circuit shown in Figure 2, the transistor parameters are: V_{TP}=-2V, K_p=1mA/V^2, λ=0, C_{gs}=15pF, and C_{gd}=3pF. (a) What is the equivalent Miller capacitance? (b) Determine the upper 3dB frequency. (c) Draw the hybrid-π model of a small-signal circuit and find the midband voltage gain. (20%)

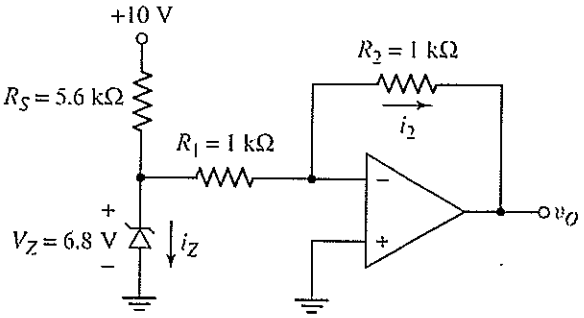

Figure 1

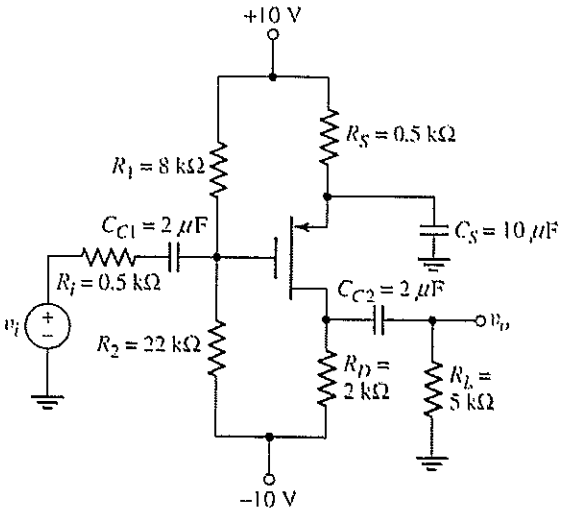

Figure 2

3、For the circuit in Figure 3, (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. (20%)

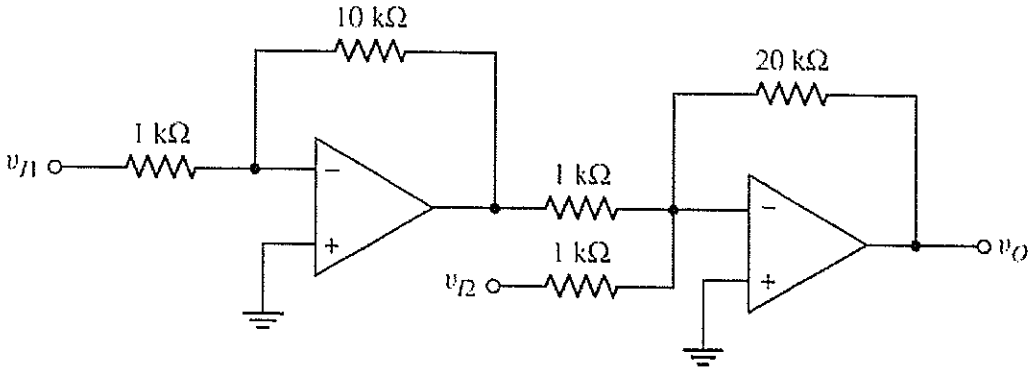

Figure 3

4、The CS amplifier of Figure 4. Assume the MOSFET is specified to have V_t=1V, k_n=4mA/V^2, λ=0. (a) Design for I_D=0.5mA, V_S=3.5V, V_D=6V and V_{DD}=15V. Specify the values of R_S and R_D. If a current of 2μA is used in the voltage divider, specify the values of R_{G1} and R_{G2}. Give the values of the MOSFET parameter g_m and r_o at the bias point (V_A=100V). (b) Draw the hybrid-π model of a CS amplifier small-signal circuit. (c) Determine R_{in}, R_o, and the overall voltage gain A_V when R_{sig}=100kΩ and R_L=20kΩ (20%)

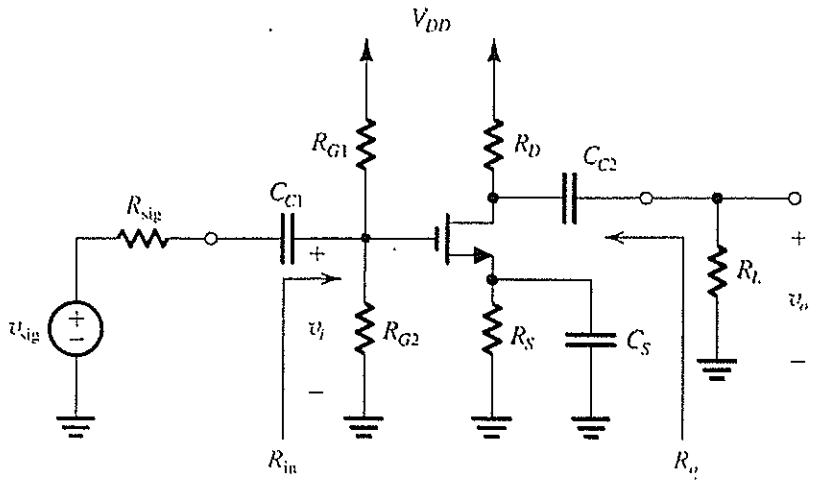

Figure 4

5、Consider the circuit shown in Figure 5. First, note diodes D_1 and D_2 are included to make design (and analysis) easier and to provide temperature compensation for the emitter—base voltages of Q_1 and Q_2. Second, note resistor R, whose purpose is to provide negative feedback. Using $|V_{BE}|$ and V_D=0.7 V independent of current, and β=∞, find (a) the voltages V_{B1}, V_{E1}, V_{C1}, V_{B2}, V_{E2}, and V_{C2}, initially with R open- circuited and (b)then with R connected. Repeat for β=100, with R open-circuited initially, then connected. (20%)

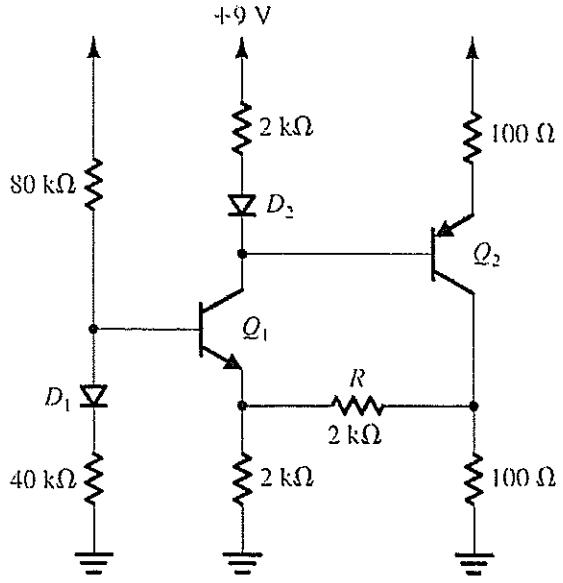

Figure 5