國立臺灣師範大學 105 學年度碩士班招生考試試題

科目：**電子學**　　適用系所：**光電科技研究所**

注意：1.本試題共 4 頁，請依序在答案卷上作答，並標明題號，不必抄題。2.答案必須寫在指定作答區內，否則依規定扣分。

第 1-4 題計算題，必需寫運算過程；第 5-10 題選擇題，無需計算過程。

1. The shunt regulator circuit uses a Zener diode D which has Vz=7.5V at Iz=20mA. The dynamic resistance is 8 Ω. The min. value of Vs is 15 V, the max value of I_L is 20mA.
   (a) If the min. allowable Iz is 6mA, find the max. usable of R. (5 points)
   (b) Find the line regulation ΔVo/ΔVs and the load regulation ($\Delta Vo/\Delta I_L$). (5 points)

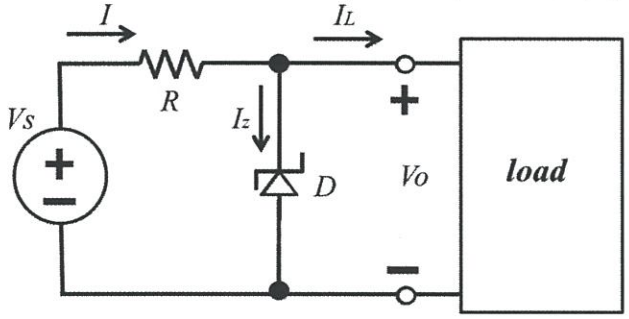

Figure 1

2. Make a comparison (advantages, disadvantages, etc) between JFET and BJT when used as (a) a low frequency amplifier (5 Points) and (b) an analog switch (5 Points).

3. The figure 2 shows a multistage amplifier circuit. All the bipolar transistors used in this circuit have a current gain (β=200), an output resistance of (r_O=∞) and the base to emitter voltage as they are biased in the active mode (V_{BE}=0.7V). kT/q=25 mV at room temperature.
   (a) Find out small signal gain $v_o/(v_1-v_2)$. (15 points)
   (b) If the 3-dB frequency of this circuit is 10 kHz, calculate the required capacitance value of the capacitor C. (15 points)

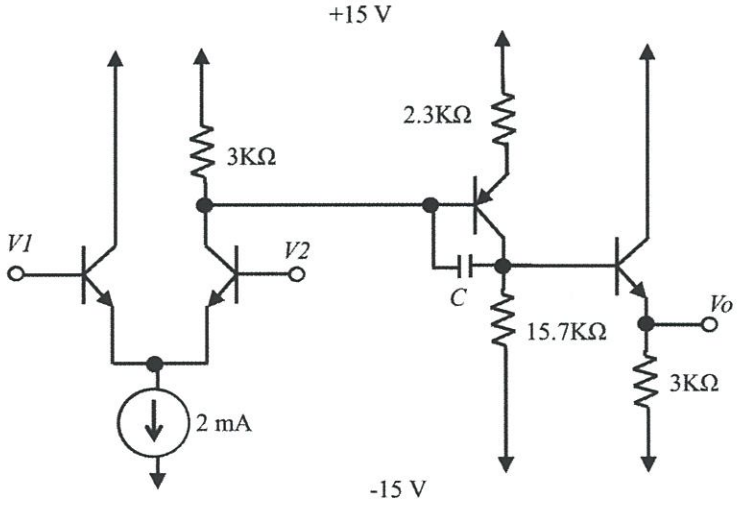

Figure 2

4. Find the voltage gain of the differential amplifier circuit of figure 3 under the condition that I=25 μA, V_t=1V, W_1=W_2=120 μm, L_1=L_2= 6μm, $\mu_n C_{OX}$=20 μA/V^2, V_A=20V. (20 points)

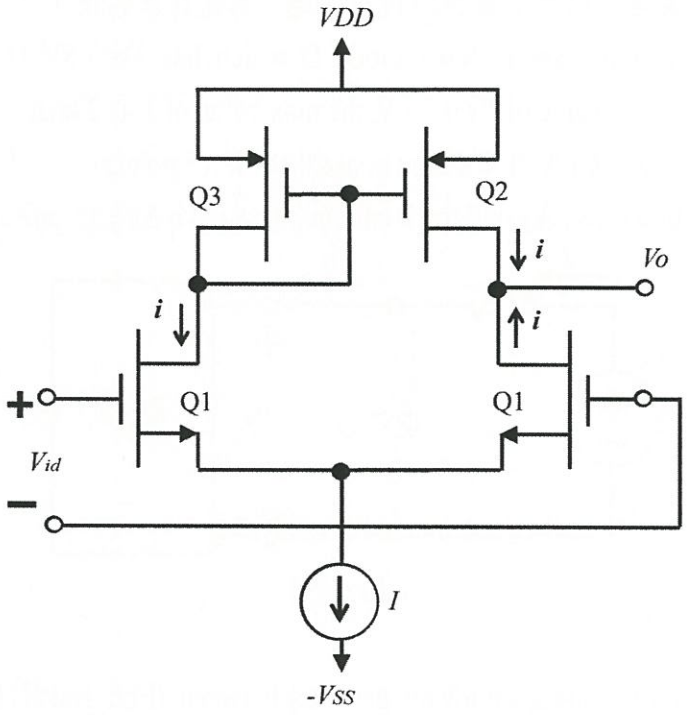

Figure 3

第 5-10 題選擇題：

5. Calculate the output voltage V_O for the circuit in figure 4. (5 points)
   (a) 2V; (b) 4V; (c) 6V; (d) 8V

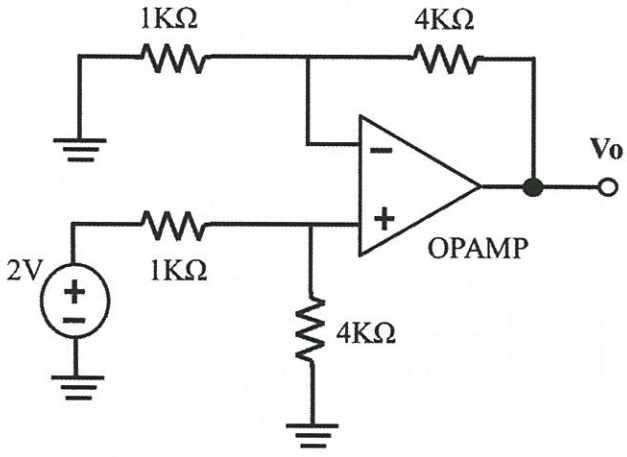

Figure 4

6. Figure 5 shows a noninverting op-Amp configuration. If A=10000, please calculate R_2/R_1 to obtain a close-loop gain A_f of 10. (5 points)
   (a) R_2/R_1=6.01; (b) R_2/R_1=7.01; (c) R_2/R_1=8.01; (d) R_2/R_1=9.01

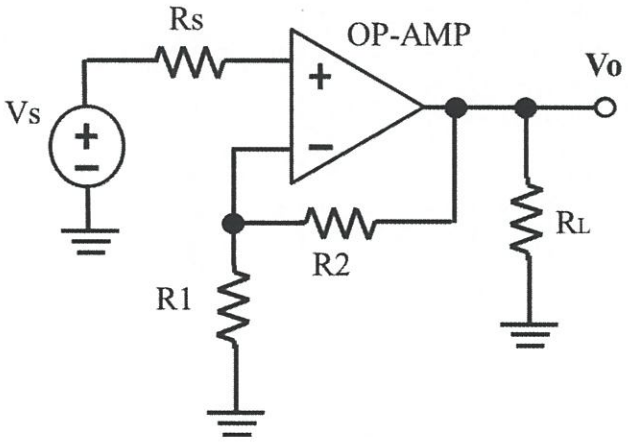

Figure 5

Design the circuit shown in below (i.e. calculate the values for R_C and R_E) to establish a collector current of 1 mA and a reverse bias on the collector-base junction of 4V. Assume α=1 and V_E=0.7V.

7. Calculate the values for R_C =? (5 points)
   (a) R_C= 6 KΩ; (b) R_C=9 KΩ; (c) R_C=9.3 KΩ; (d) R_C=6 KΩ.
8. And calculate the values for R_E =? (5 points)
   (a) R_E=6 KΩ; (b) R_E=9 KΩ; (c) R_E=6 KΩ; (d) R_E=9.3 KΩ.

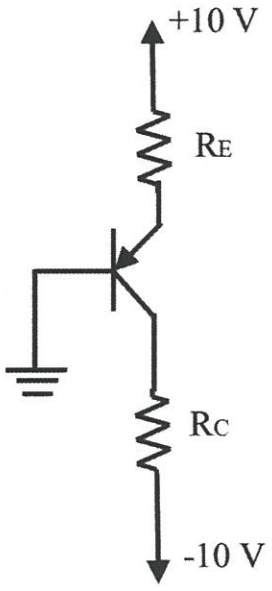

Figure 6

Consider the typical common source MOSFET circuit shown in figure 7, where R_S=2.2 KΩ, R_1=56 KΩ, R_2=33 KΩ, R_D=4.7 KΩ; the transistor parameters g_m= 2mA/V, r_o=100 KΩ, and V_{DD}=10 volts. Assuming the impedance of the capacitance C_{C1} is small enough for the ac signal of concern.

9. Calculate the input resistance of the circuit. (5 points)

   (a) R_{in}= 5.5 KΩ; (b) R_{in}=20.7 KΩ; (c) R_{in}=10.5 KΩ; (d) R_{in}= 30.7 KΩ .

10. Calculate the output resistance of the circuit. (5 points)

   (a) R_{out}= 5 KΩ ; (b) R_{out}= 10.5 KΩ ; (c) R_{out}= 5.5 KΩ ; (d) R_{out}= 4.5 KΩ .

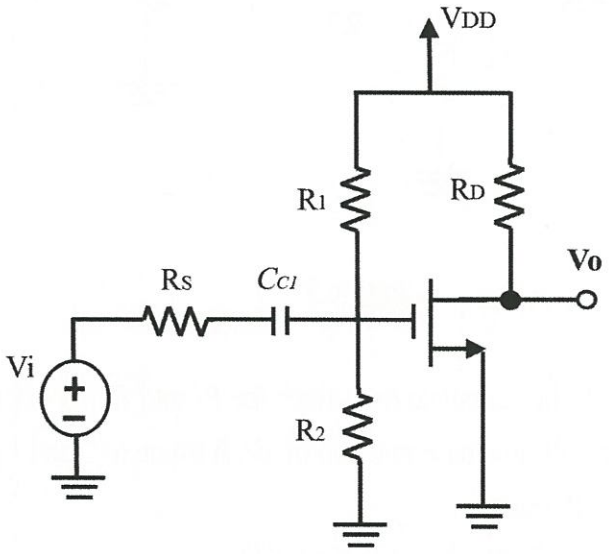

Figure 7