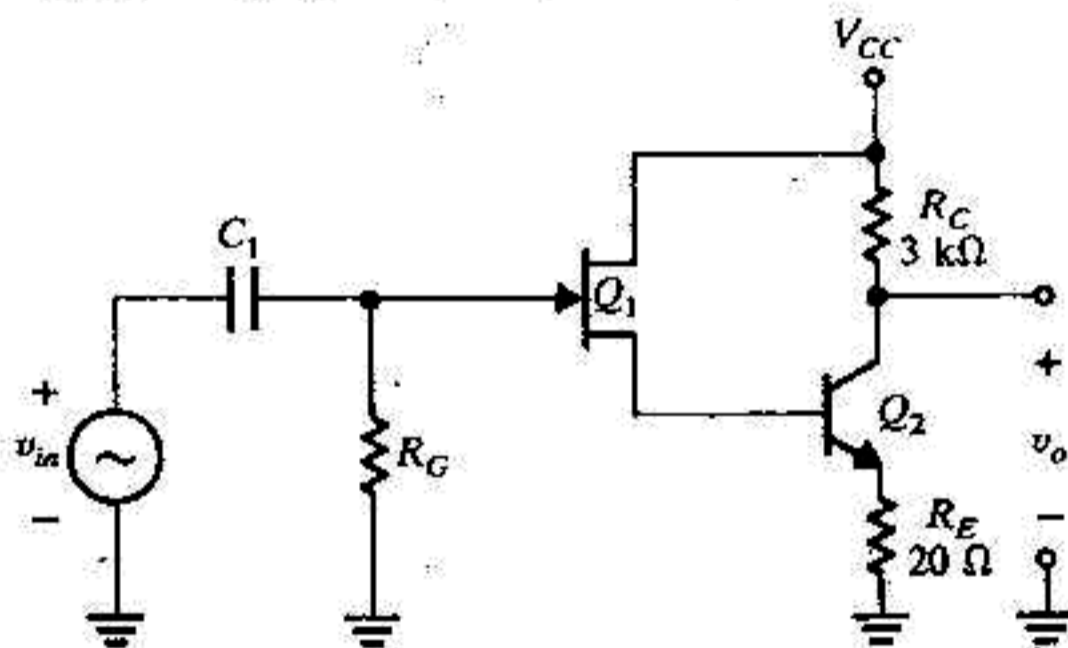


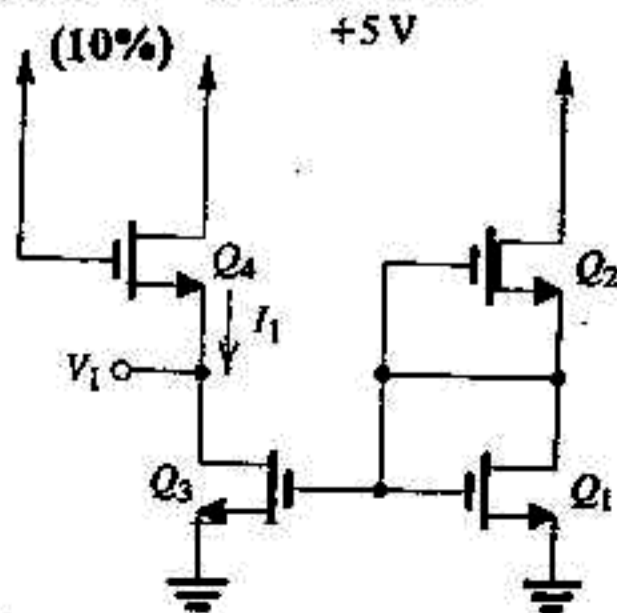
- A 6.8 V Zener diode specified at 5 mA to have  $V_Z = 6.8$  V and  $r_Z = 20$   $\Omega$  with  $I_{ZK} = 0.2$  mA, is operated in a regulator circuit using a 200  $\Omega$  resistor and a 9 V supply.

  - Estimate the knee voltage of the Zener. (5%)
  - For no load, what is the lowest supply voltage for which the Zener remains in breakdown operation? (5%)
  - For the nominal supply voltage, what is the maximum load current for which the Zener remains in breakdown operation? (5%)

- The two-transistor amplifier shown in the following Figure combines an FET and a BJT to achieve both a high input impedance and a large voltage gain. By considering the  $g_m$  of  $Q_1$  to be 1 mS (or 1 mA/V), and  $r_x$  and  $\beta$  for  $Q_2$  to be 1 k $\Omega$  and 100, respectively, determine the voltage gain  $v_o/v_{in}$  of the amplifier. (10%)



- For the devices in the circuit of the following Figure,  $|V_t| = 1$  V,  $\lambda = 0$ ,  $\gamma = 0$ ,  $\mu_n C_{ox} = 20$   $\mu$ A/V<sup>2</sup>,  $L = 1$   $\mu$ m, and  $W = 20$   $\mu$ m. Find the labeled current ( $I_1$ ) and voltage ( $V_1$ ). (10%)

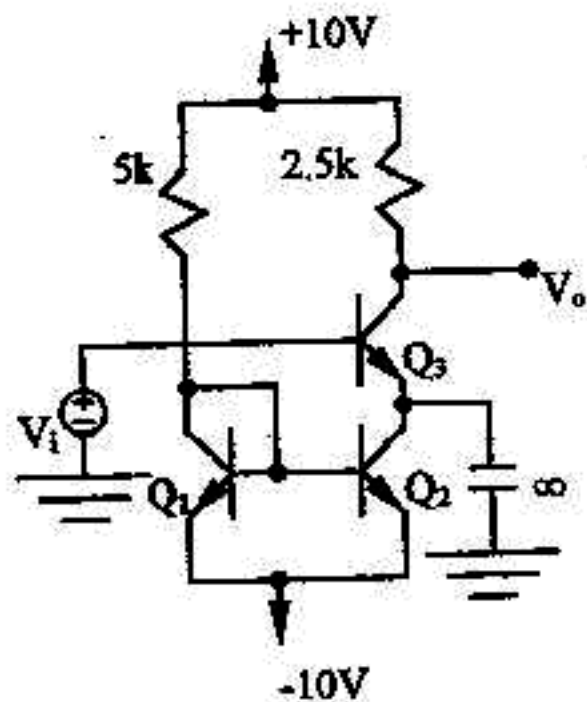


4. In the circuit, the BJTs have  $\beta=100$  and  $r_o=\infty$ .

(1) Determine the dc voltages  $V_{c2}$  and  $V_{c3}$ .

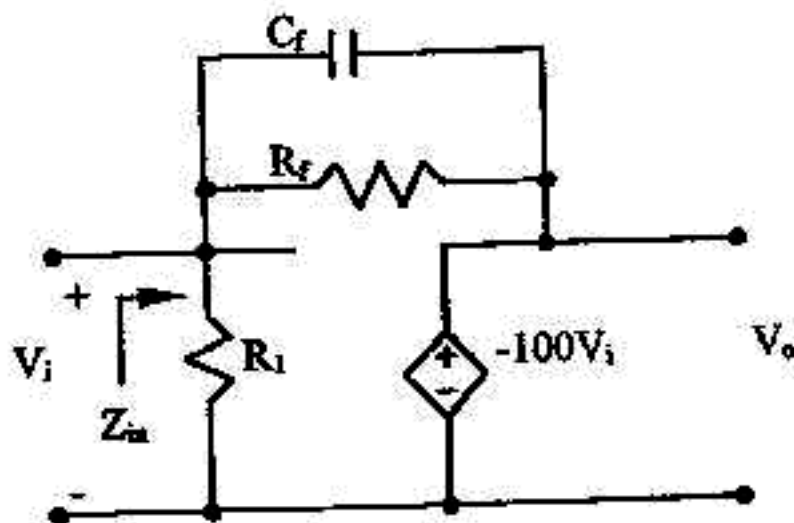
(2) Find the voltage gain  $V_o/V_i$ .

(10%)



5. An amplifier can be modeled by the equivalent circuit as shown. Find the input impedance  $Z_{in}$  and the pole of  $V_o/V_i$ .

(10%)



八十八學年度 \_\_\_\_\_ 電機工程 \_\_\_\_\_ 系(所) \_\_\_\_\_ 乙 組碩士班研究生招生考試

目 電子學 \_\_\_\_\_ 科號 4502 共 3 頁第 3 頁 \*請在試卷【答案卷】內作答

6. The rated junction temperature of a power BJT is  $T_{j,max}=150\text{ }^{\circ}\text{C}$ . The thermal resistance for the BJT package are  $\theta_{j-case}=2\text{ }^{\circ}\text{C/W}$  and  $\theta_{case-amb}=18\text{ }^{\circ}\text{C/W}$ . It is operated to dissipate a power of 5W.

(1) Find the maximum allowable ambient temperature  $T_{a,max}$  when it is operated without heat sink.

(2) If the BJT is attached to a heat sink which gives  $\theta_{case-sink}=4\text{ }^{\circ}\text{C/W}$  and  $\theta_{sink-amb}=6\text{ }^{\circ}\text{C/W}$ , find  $T_{a,max}$ .

(10%)

7. (a) Write the 2nd order band-pass filter function  $T(S)=?$  5%

(b) For the same band-pass filter function  $T(S)$ , if  $|T(\omega_a)|=|T(\omega_b)|$  and  $\omega_a \neq \omega_b$ , find  $\omega_a \cdot \omega_b = ?$ .  
(15%)

10%

8. (20%) Draw a decoder used for memory with 3 address lines in transistor level. Also show the logic function of each output.