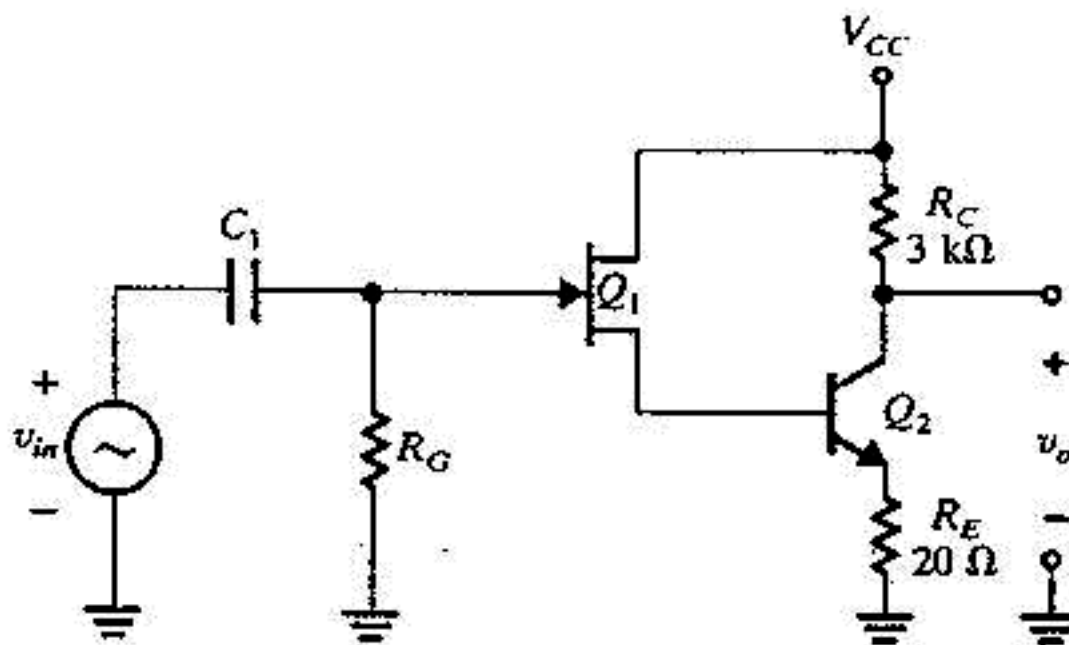
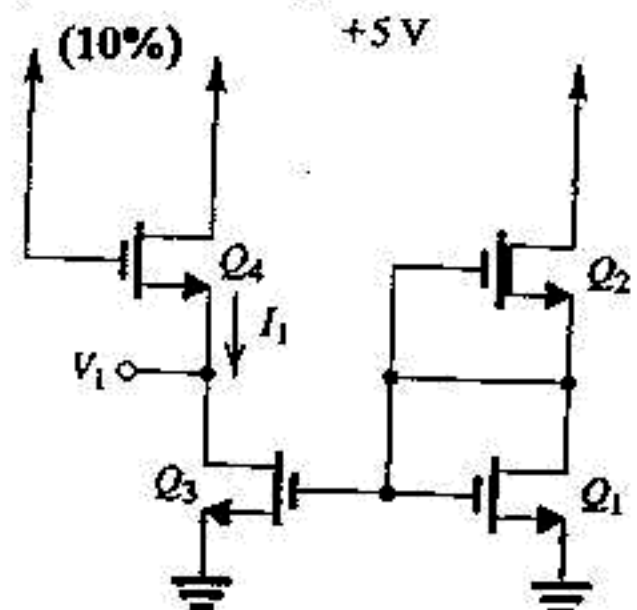


- A 6.8 V Zener diode specified at 5 mA to have $V_Z = 6.8$ V and $r_Z = 20$ Ω with $I_{ZK} = 0.2$ mA, is operated in a regulator circuit using a 200 Ω resistor and a 9 V supply.

 - 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 β for Q_2 to be 1 k Ω 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, $\lambda = 0$, $\gamma = 0$, $\mu_n C_{ox} = 20$ μ A/V², $L = 1$ μ m, and $W = 20$ μ m. Find the labeled current (I_1) and voltage (V_1). (10%)



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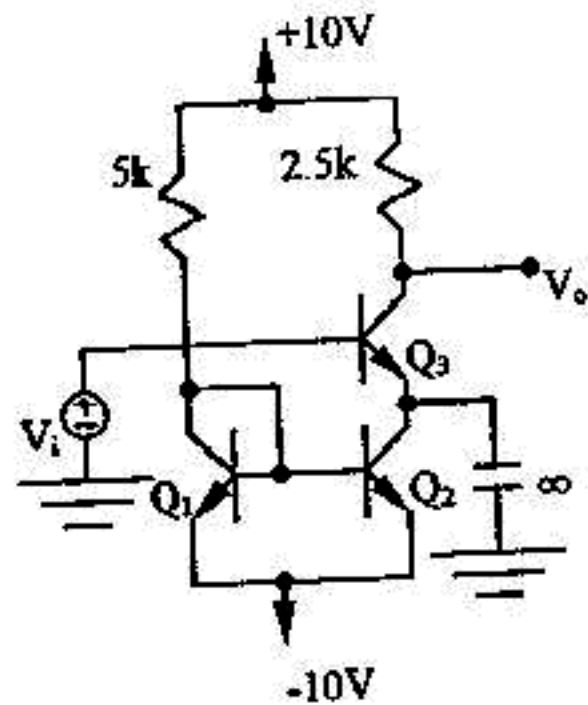
科目 電子學 科號 4202/4502 4603 共 3 頁第 2 頁 *請在試卷【答案卷】內作答

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

(1) Determine the dc voltages V_{C2} and V_{C3} .

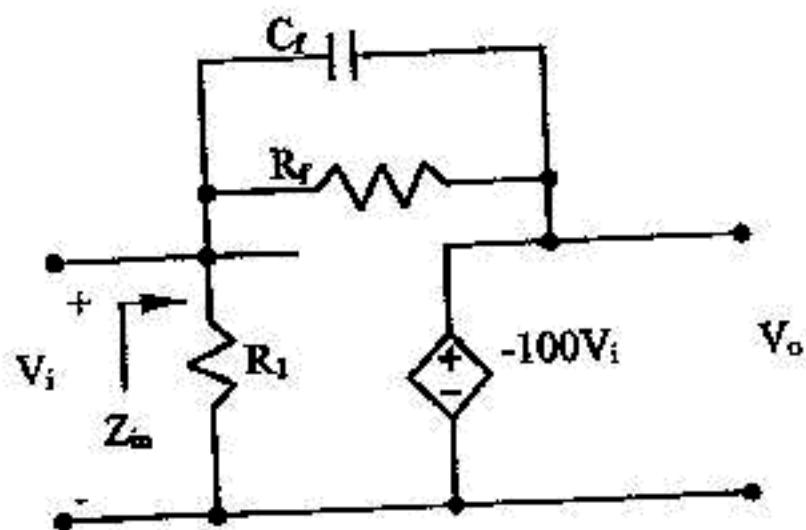
(2) Find the voltage gain V_o/V_i .

(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%)



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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 $\theta_{dev-case}=2\text{ }^{\circ}\text{C/W}$ 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%)

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