系所組別：工程科學系甲、戊組

考試科目：電子電路 考試日期：0223，節次：1

※ 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。**請依題號順序作答。**

1. Mark each of the following statements True (T) or False (F). (Need NOT to give reasons.) (20 分)

(a) When performing DC analysis, the capacitors including coupling, bypass, and internal parasitic capacitors should be opened circuit because their impedances are zero.

(b) When performing low-frequency response analysis, the coupling and bypass capacitors should be analyzed, while internal parasitic capacitors should be shorted circuit.

(c) When performing high-frequency response analysis, the internal parasitic capacitors should be analyzed, while coupling and bypass capacitors should be opened circuit.

(d) The ideal voltage amplifier has infinite input resistance, zero output resistance, and infinite voltage gain.

(e) The common drain amplifier can be used to obtain the bulk of the voltage gain.

(f) The input stage of an operational amplifier typically uses the differential amplifier to reject the common-mode signals.

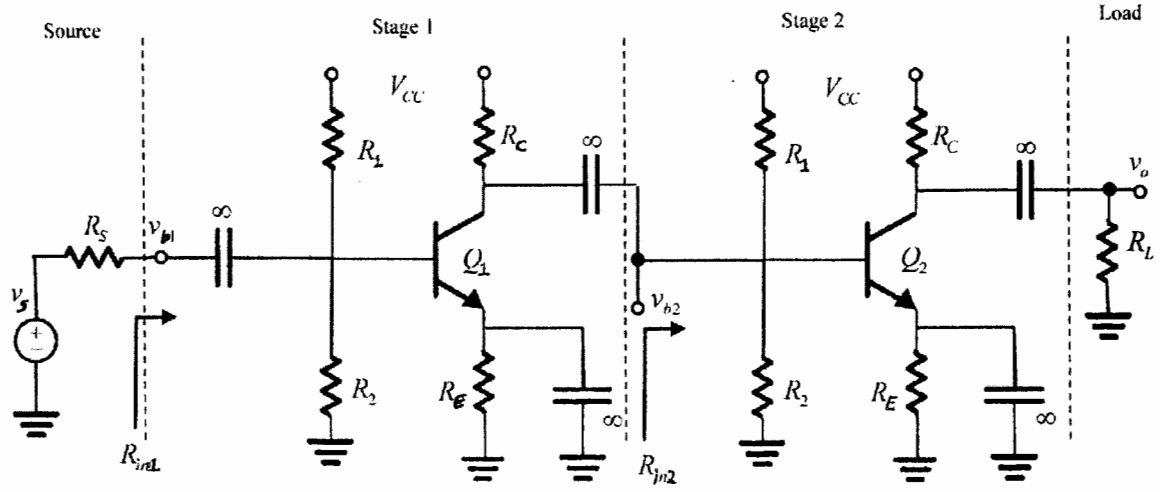
(g) Feedback can be used to extend the bandwidth of an amplifier.

(h) Feedback cannot desensitize the closed-loop gain introduced by the variation of the open-loop gain of the basic amplifier.

(i) The current mirror is typically employed to bias the discrete-component circuits.

(j) The saturation region of an MOS is used to amplify the small signals.

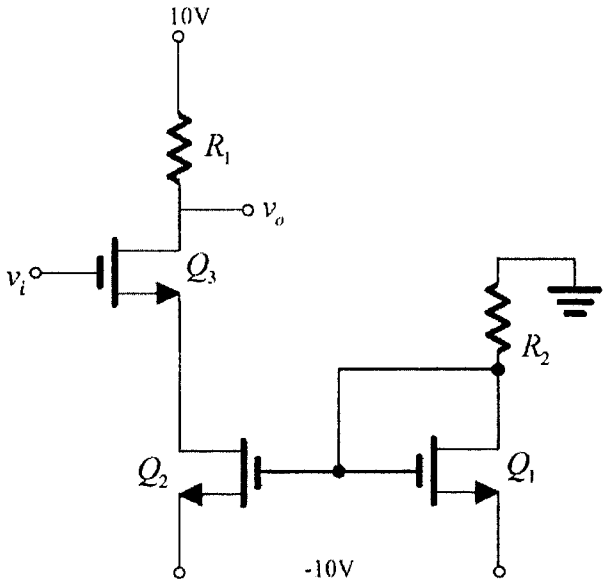
2. The amplifier consists of two identical common-emitter amplifiers connected in cascade. $V_{CC}=15\text{V}$, $R_1=100\text{K}\Omega$, $R_2=47\text{K}\Omega$, $R_E=3.9\text{K}\Omega$, $R_C=6.8\text{K}\Omega$, $\beta=100$ and $V_T=25\text{ mV}$. Neglect the output resistance r_{o1} and r_{o1} for both transistors. (a) Determine the DC collector current and collector voltage of each transistor. (4 分) (b) Find R_{in1} and v_{b1}/v_s for $R_S=5\text{K}\Omega$. (4 分) (c) Find R_{in2} and v_{b2}/v_{b1}. (4 分) (d) For $R_L=2\text{K}\Omega$, find v_o/v_{b2}. (4 分) (e) Find the overall voltage gain v_o/v_s. (4 分)



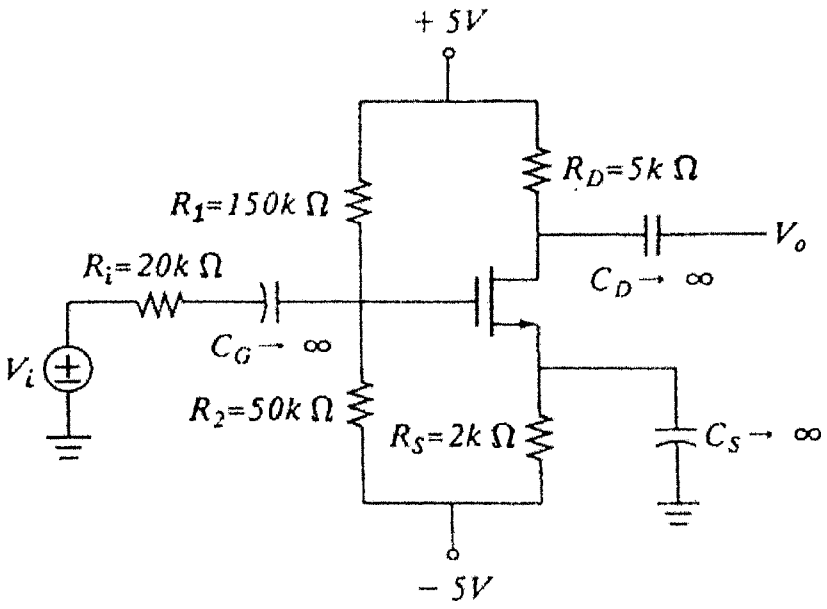
(背面仍有題目，請繼續作答)

※ 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。

3. Consider the circuit shown below. All transistors are identical with $\frac{1}{2}k_n'\left(\frac{W}{L}\right)=1\ \text{mA/V}^2$, $V_t=2\text{V}$, and $V_A=1/\lambda=\infty$. $R_1=500\Omega$ and $R_2=250\Omega$. (a) Determine the bias drain current of Q_3. (6 分) (b) Determine the small-signal voltage gain. (8 分) (c) What is the allowed range of v_i for Q_1, Q_2 and Q_3 operating in the saturation region? (6 分)



4. For the circuit shown below, the transistor has $\frac{1}{2}k_n'\left(\frac{W}{L}\right)=1\ \text{mA/V}^2$, $V_t=0.8\text{ V}$, $r_o=\infty$, $C_{gs}=2\,pF$, and $C_{gd}=0.2\,pF$. Determine: (a) the midband voltage gain V_o/V_i (10 分), and (b) the upper 3-dB frequency, f_H in Hz. (10 分). Hint: You can apply Miller's theorem and, then use the open-ckt time constant.



系所組別：工程科學系甲、戊組

考試科目：電子電路

※ 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。

5. The transistors Q_1 and Q_2 have $h_{fe} = 80$ and $V_T = 25$ mV, and are biased at $I_{c1} = 0.2$ mA and $I_{c2} = 8$ mA, respectively. (a) What are the feedback β and the ***current gain*** of basic amplifier *A*? (10 分)
(b) Find $A_f \equiv V_o / V_S$ and R_{in}. (10 分)