國立台灣科技大學九十五學年度碩士班招生試題

系所組別： 電機工程系碩士班乙二組、丙二組

科　　目： 電子學

總分100分

1. Consider the circuit in Figure 1. Find the differential voltage gain v_o / v_{Id}. (10%)

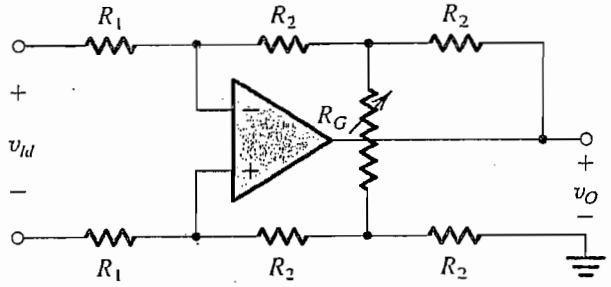

Figure 1

2. For the circuits in Figure 2, assume that each transistor is sized and biased so that $g_m = 1\text{mA/V}$ and $r_o = 100\text{k}\Omega$. Otherwise, ignore all dc biasing detail and concentrate on small-signal operation resulting in response to the input signal v_{sig}. For $R_L = 10\text{k}\Omega$, $R_1 = 500\text{k}\Omega$, and $R_2 = 1\text{M}\Omega$, find the overall voltage gain v_o / v_{sig} and the input resistance R_{in} for each circuit. (20%)

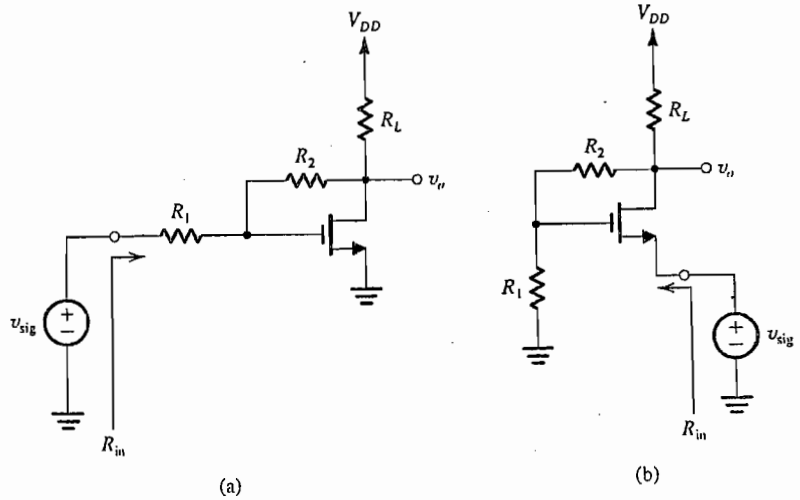

Figure 2

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3. For the emitter follower shown in Figure 3, the signal source is directly coupled to the transistor base. If the dc component of v_{sig} is zero, find the dc emitter current. Assume $\beta = 100$ and $V_T = 25\text{mV}$. Neglecting r_o, finding R_{in}, the voltage gain v_o / v_{sig}, the current gain i_o / i_i, and the output resistance R_{out}. (20%)

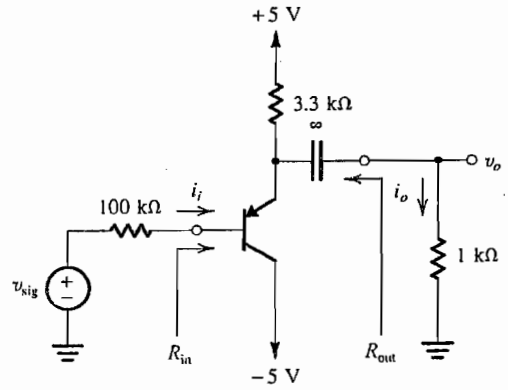

Figure 3

4. Find the quiescent values of I_C and V_{CE} in each of Q_1, Q_2, Q_3, in Figure 4, assuming each transistor has β=160. (15%)

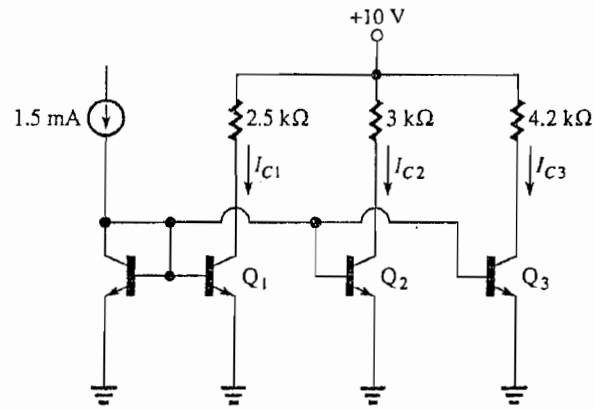

Figure 4

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5. Let the op amp of Figure 5 have r_d = 1 MΩ, a= 10^4 V/V, and r_O = 100 Ω.

(a) Find β and loop gain, T. (10%)

(b) Find the ideal as well as the actual transfer characteristic of the circuit. (10%)

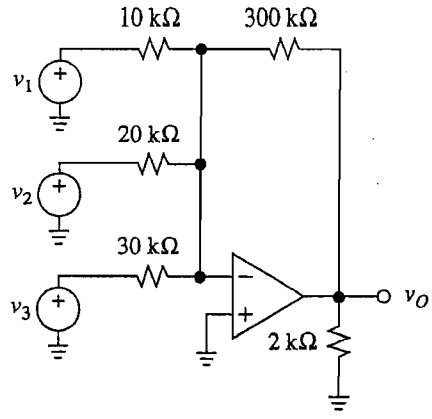

Figure 5

6. The gain of a certain amplifier as a function of frequency is $A(j\omega)=\frac{-16\cdot 10^6}{j\omega}$. A feedback path connected around it has $\beta(j\omega)=\frac{10^3}{(2\cdot 10^3+j\omega)^2}$. Will the system oscillate? If so, at what frequency? (15%)

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