國立彰化師範大學 98 學年度碩士班招生考試試題

系所：電機工程學系　　科目：電子學

☆☆請在答案紙上作答☆☆　　

1. Find the output voltage v_O and the current i_O for the amplifier in Figure 1. Assume the input voltage to be v_I. (10%)

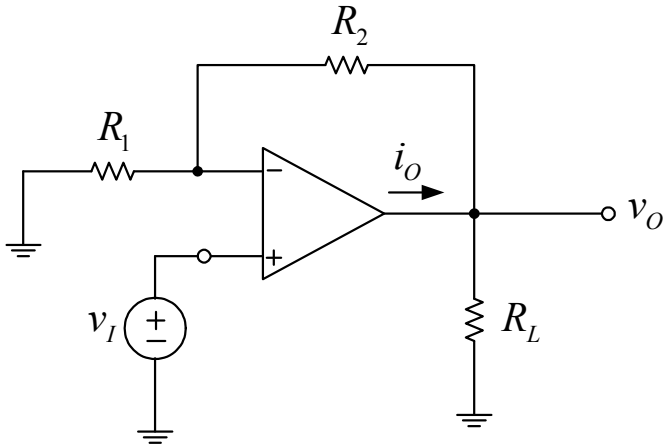

Figure 1

2. Derive an expression in terms of the input voltage V_{IN} for the output voltage V_{OUT} in the circuit of Figure 2. Assume the current of the diode to be $I_D = I_S e^{V_D/nV_T}$. (10%)

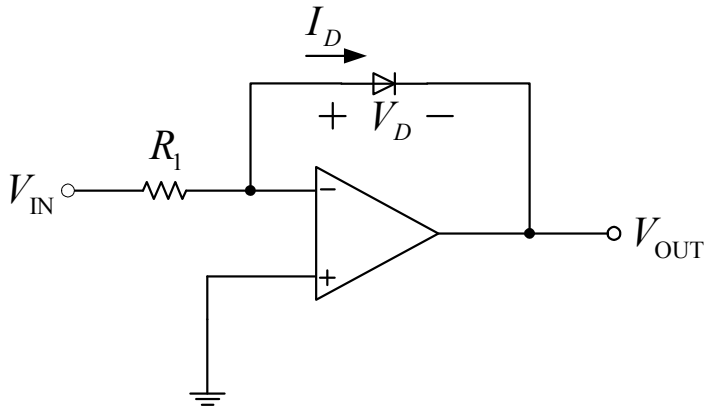

Figure 2

3. In the circuit of Figure 3, the transistor has a β of 100. Find the input resistance R_{in} and the overall voltage gain $\left(v_o/v_{\text{sig}}\right)$. (10%)

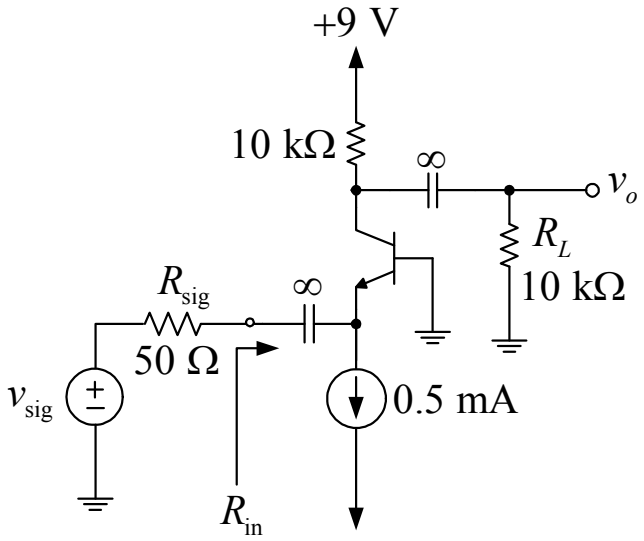

Figure 3

4. Consider the amplifier in Figure 4, and neglect r_o.

(a) Show that the midband gain is given by $A_M = -g_m R_D / (1 + g_m R_S)$. (10%)

(b) If the amplifier is biased to operate at $I_D = 1$ mA and $g_m = 1$ mA/V, evaluate the midband gain, and the value of C_S that places f_L at 10 Hz. (10%)

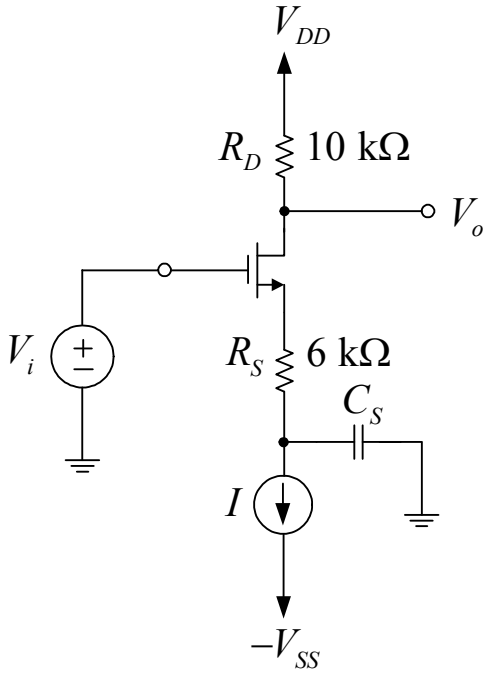

Figure 4

5. Consider the differential amplifier in Figure 5. Show that if all transistors have equal transconductances g_m and equal Early voltages $|V_A|$ and are operated at an overdrive voltage V_{OV}, the gain is given by $A_d = 2(V_A/V_{OV})^2$. (10%)

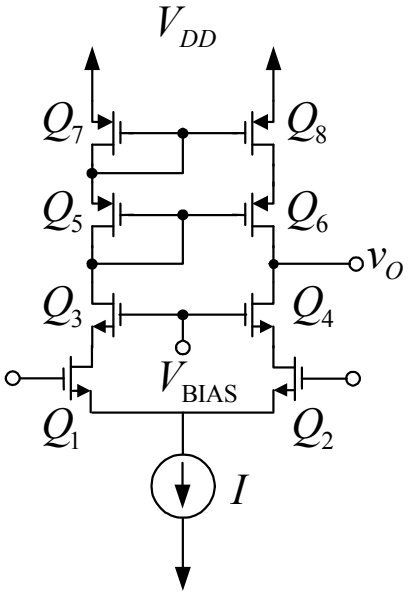

Figure 5

6. The open-loop gain of an amplifier is given by

$$A(f) = \frac{5\times 10^3}{\left(1+j\frac{f}{10^4}\right)\left(1+j\frac{f}{10^5}\right)^2}$$

Assume that the feedback factor β is not a function of frequency.

(a) Determine the value of β at which the amplifier can break into oscillation. (10%)

(b) If a phase margin of 45° is required, what should be the value of β? (10%)

7. It is required to design a class AB output stage in Figure 6 to deliver an average power of 16 W to an 8-Ω load. The peak output voltage is chosen to be no more than 80 percent of V_{CC}. Determine the supply voltage required, the peak current

drawn from each supply, the total supply power, and the power-conversion efficiency. (20%)

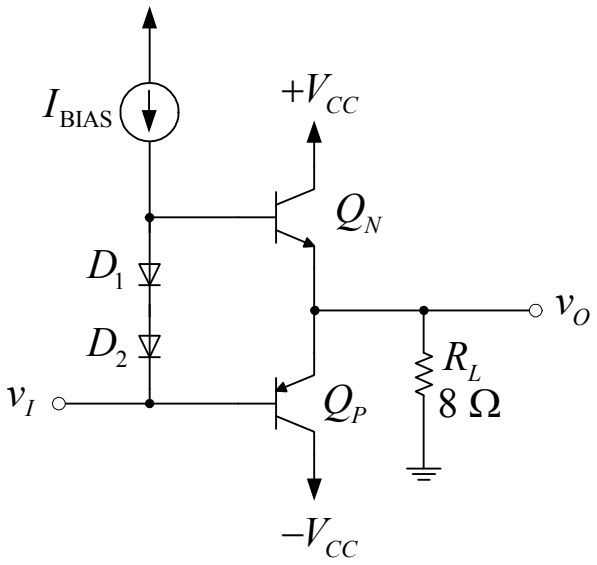

Figure 6