國立雲林科技大學
100學年度碩士班暨碩士在職專班招生考試試題

系所：電子光電所
科目：電子學(2)

1. Both the basic current mirror and cascode current mirror are shown in Fig. 1, please answer following questions:

(a) (5%) Point out the reason of current mismatch in the basic current mirror and express the output current I_o of the basic current mirror in terms of I_{REF}.

(b) (5%) State the reason that the cascode current mirror have an advantage over the basic current mirror.

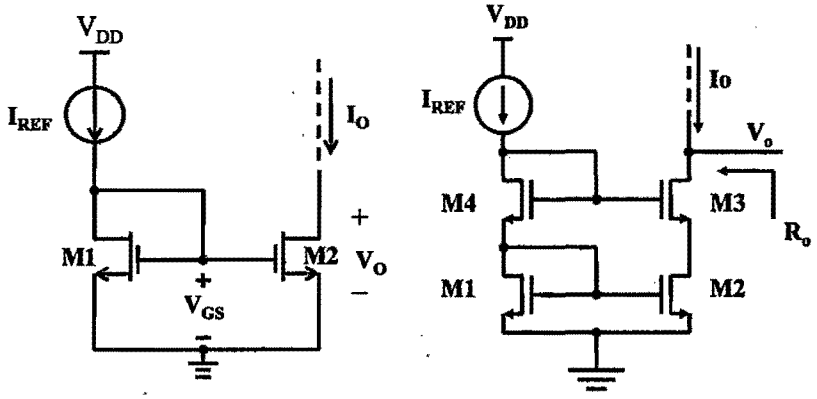

Fig. 1

2. The amplifier shown in Fig. 2 has $R_{sig} = R_L = 1\,k\Omega$, $R_C = 1\,k\Omega$, $R_B = 47\,k\Omega$, $\beta = 100$, $C_\mu = 0.8$ pF, and $f_T = 600$ MHz.

(a) (5%) Find the dc collector current of the transistor.

(b) (5%) Find g_m and r_π.

(c) (5%) Find the midband voltage gain from base to collector (Neglect the effect of r_o and R_B) and use the gain to find the R_{in}.

(d) (5%) Find C_{in}.

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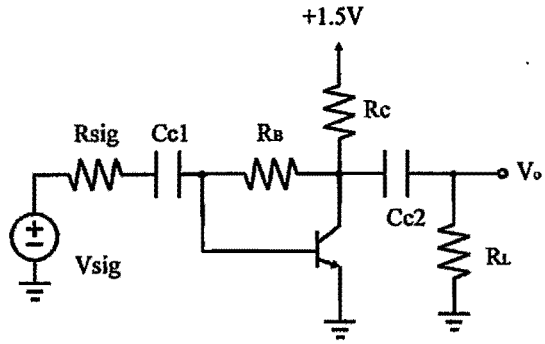

Fig. 2

3. An amplifier having a low-frequency gain of 10^3 and poles at 10^4 Hz and 10^5 Hz is operated in a closed negative-feedback loop with a frequency- independent β.

(a) (5%) For what value of β do the closed-loop poles become coincident, i.e. pole 1 equal to pole 2? And at what frequency?

(b) (5%) What is the low-frequency gain corresponding to the situation in (a)? What is the value of the closed-loop gain at the frequency of the coincident poles?

(c) (5%) What is the value of quality factor Q corresponding to the situation in (a)?

(d) (5%) If β is increased by a factor 10, what are the new pole locations?

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4. (20%) (a) If A is an ideal amplifier, $\frac{v_{out}}{v_{in}} = ?$ (b) If $A(s) = \frac{A_0}{1 + s/\omega_p}$, where $A_0 = 80dB$ and $\omega_p = 2\pi \times 100$ rad/sec, what is the 3dB frequency of the closed-loop amplifier?

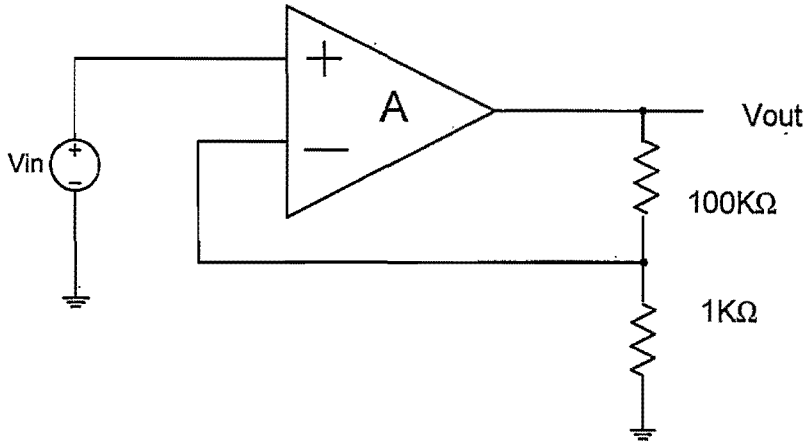

Fig. P4

5. (10%) If the effect of channel-length modulation is negligible, calculate the low-frequency small-signal voltage gain. Note that $\mu_n = 4\mu_p$ and $(\frac{W}{L})_n = 4(\frac{W}{L})_p$.

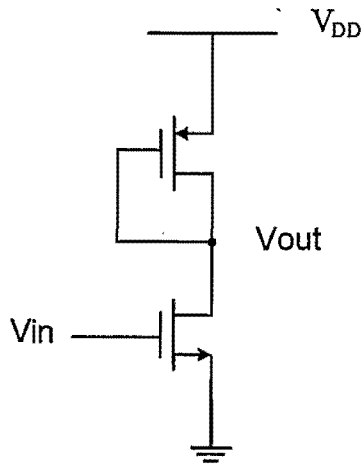

Fig. P5

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6. (20%) If the operational amplifier A is ideal, write down (a) the differential gain $\frac{v_{out}}{v_2 - v_1} = ?$ (b) the input resistance of the differential amplifier.

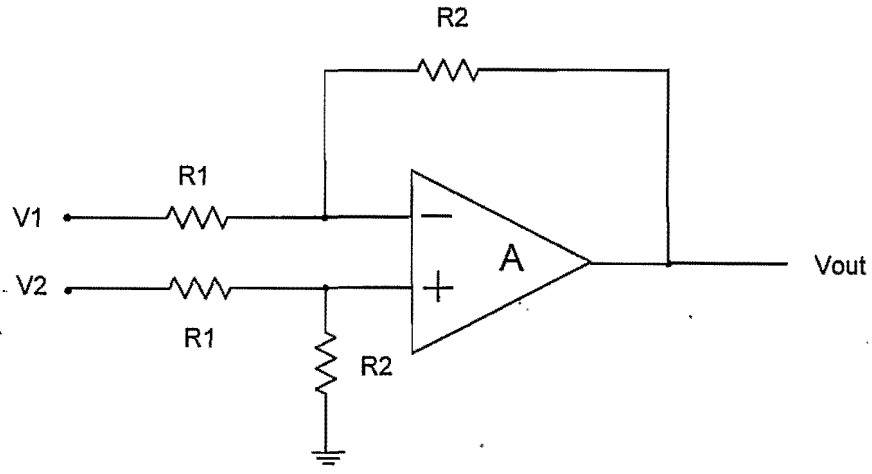

Fig. P6