

國立暨南國際大學九十二學年度碩士班研究生入學考試試題

第 1 節電子學 適用:(電機所電子組 421)

(本試題共 2 頁, 第 1 頁)

考生注意: 1. 依次序作答, 只要標明題號, 不必抄題。

2. 答案必須寫在答案卷上, 否則不予計分, 並限以藍黑色筆作答。

3. 試題隨卷繳回。(餘請詳閱試場規則)

1. For the amplifier topology shown in Fig. 1,

(a) determine the small-signal voltage gain V_o/V_s . (20 points)

(b) show that for large loop gain $\frac{V_o}{V_s} \approx -\frac{R_f}{R_s}$. Calculate this value for the components values given on the circuit diagram, and compare the result to that found in (a). (10 points)

2. For the amplifier topology shown in Fig. 2, show that the upper 3-dB frequency can be expressed as follows. (20 points)

$\omega_H = \frac{1}{[C_{gs} + C_{gd}(1 + g_m(R_L \parallel r_o))]R_s}$, in which g_m , C_{gs} , C_{gd} , r_o is the small-signal transconductance, gate-source capacitance, gate-drain capacitance, and output resistance of nMOSFET Q, respectively.

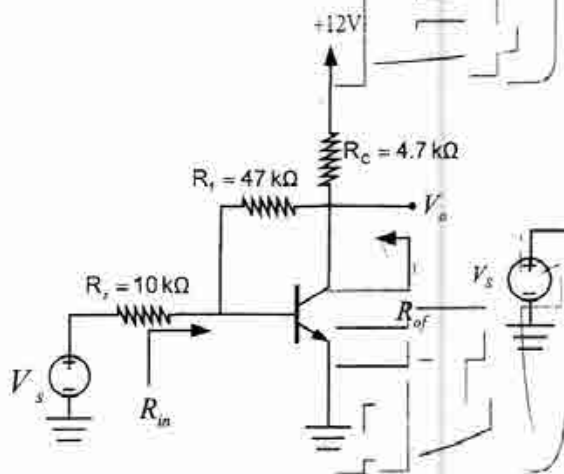


Fig. 1

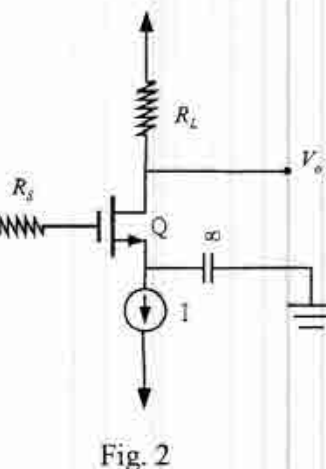


Fig. 2

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3. 試題隨卷繳回, (餘詳詳閱試場規則)

3. Fig. 3 is a CMOS buffer amplifier. As a buffer, the output is connected to the inverting input (in-) and the input signal is applied to the non-inverting terminal (in+). In the stable state, the output voltage equals to the input voltage. The aspect ratios of all transistors are listed in Table 1. Calculate the dc currents ($I_1 \sim I_7$) labeled in the figure.

(a) I_1 (2 points)

(b) I_2 (1 points)

(c) I_3 (1 points)

(d) I_4 (5 points)

(e) I_5 (5 points)

(f) I_6 (8 points)

(g) I_7 (3 points)

4. An op amp with an open-loop voltage gain of 80 dB and poles at 10^5 , 10^6 , and 2×10^6 Hz is to be compensated to be stable for unity β . Assume that the op amp incorporates an amplifier equivalent to that in Fig. 4, with $C_1 = 150$ pF, $C_2 = 5$ pF, and $g_m = 40$ mA/V, and that f_{p1} is caused by the input circuit and f_{p2} by the output circuit of this amplifier.

(a) Find the required value of the compensating Miller capacitance. (15 points)

(b) Find the new frequency of the output pole. (10 points)

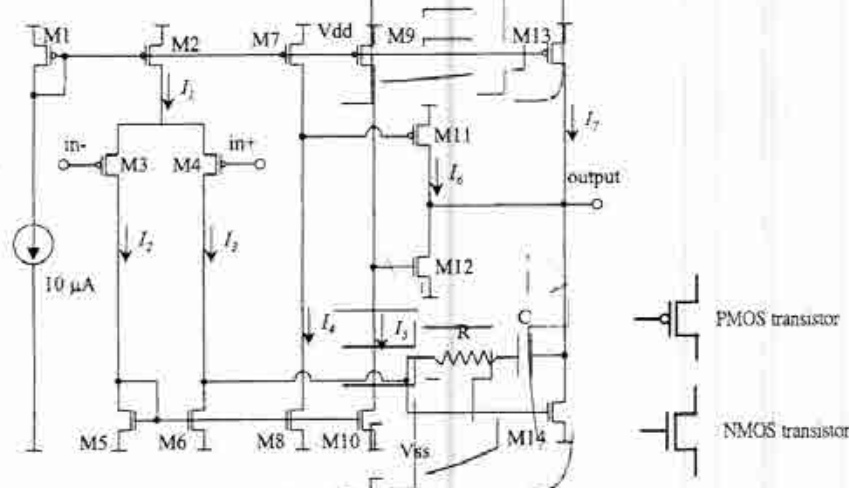


Fig. 3

Table 1

Transistors	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12	M13	M14
(W/L)	20/2	40/2	100/2	100/2	20/2	20/2	30/2	20/2	20/2	30/2	30/1	10/1	40/2	40/2
$\mu\text{m}/\mu\text{m}$														

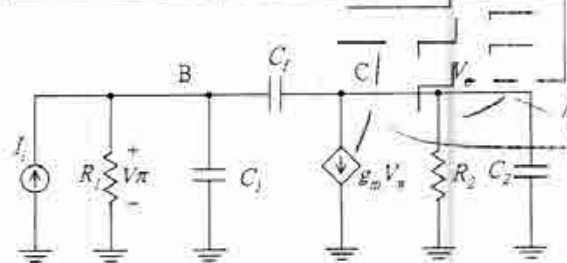


Fig. 4