元智大學 102 學年度研究所 碩士班 招生試題卷

系(所)別：電機工程學系碩士班　組別：數位科技組　科目：電子學　用紙第 1 頁共 2 頁

※不可使用電子計算機

1. (20%) A n-channel enhance MOSFET has a drain current i_D of 9 mA at $V_{GS} = V_{DS} = 10$ V and of 1 mA at $V_{GS} = V_{DS} = 4$ V. Find (a) $k'_n(W/L)$ (10%), and (b) V_{tn} (10%) for the device.

2. (10%) Sketch a pass-transistor logic (PTL) circuit that realizes the function $Y = AC + B\overline{C}$.

3. (10%) Explain the reason why the output voltage decays for dynamic logic circuits at a very low operating frequency.

4. (55%)A two stage amplifier with feedback network is shown in Fig. 1. For the following circuit, assume λ=0 and transconductances of transistors M_1 and M_2 are g_{m1} and g_{m2}, respectively. Meanwhile, R_F is very large.
   (a) Please indicate which transistor will be suffered from body effect. (5%)
   (b) What components construct the first stage of the amplifier? (5%)
   (c) What components construct the second stage? (5%)
   (d) What components construct the feedback network? (5%)
   (e) What kind of feedback topology is it? (5%)
   (f) Please derive the open-loop input impedance? (5%)
   (g) Please derive the open-loop output impedance? (5%)
   (h) Please derive the open-loop voltage gain? (5%)
   (i) Please derive the closed-loop voltage gain? (5%)
   (j) Please derive the closed-loop input impedance? (5%)
   (k) Please derive the closed-loop output impedance? (5%)

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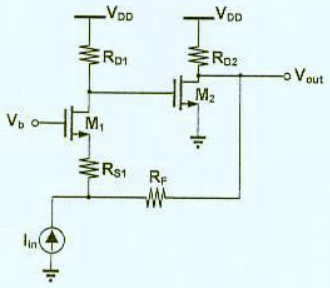

Fig. 1

5. (5%) Please derive the output impedance of the circuit shown in Fig. 2 if the transconductances of transistors Q_1 and Q_2 are g_{m1} and g_{m2}, respectively. Meanwhile, all of the transistors are with current gain of β and $V_A=\infty$

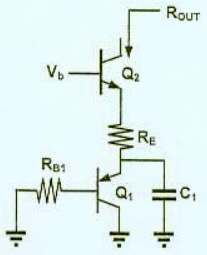

Fig. 2