

ENEE 302 Midterm Spring 2002

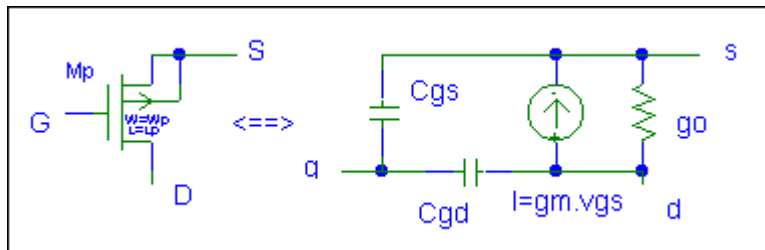
Work all problems and show your work for partial credit. 100 points. Your signature guarantees the work is your own - only signed exams will be graded.

Open book, open notes; Good luck

1. [15 minutes, 30 points]

For the small signal equivalent circuit shown below, find the values for the mutual conductance, g_m , and output conductance, g_o , using the PMOS law for drain current when in saturation

$$i_D = -\beta(-v_{GS} + V_{thp})^2(1 - \lambda v_{DS})$$

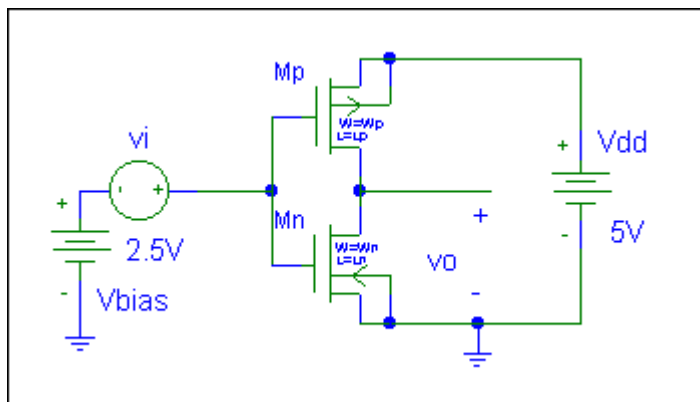


2. [20 minutes, 35 points]

Assuming that the NMOS and PMOS small signal quantities are identical

a) draw the small signal equivalent circuit for the following inverter [hint: note that both transistors are in saturation at the given bias point and that the circuit of problem 1 holds].

b) find the transfer function $v_o/v_i(s)$ at this bias point assuming $C_{gs}=C_{ds}=C$.



3. [25 minutes, 35 points]

For the following bias circuit assume that $R_L=1\text{ K}\Omega$, $R_E=980\text{ }\Omega$, $V_{BE}=0.6\text{V}$, and other values as given on the schematic.

- Find I_C , α , β , I_B , V_2 and V_1 .
- Show that R_1 or R_2 is free to be chosen.
- One would like R_1 and R_2 large. Assuming passive resistors, show that R_1 can **not** be as large as $1\text{ Meg}\Omega$, but it can be chosen to be $100\text{ K}\Omega$.
- If R_1 is chosen as $100\text{ K}\Omega$, what is the DC power supplied by V_{CC} ?

