File: G/coursesF12/303/303F12Midtrm.doc RWN 10/25/12

ENEE 303 Fall 2012 – Midterm Exam Th 10/25/12

Open book open notes but not open computers; 100 points total (75 minutes); if stuck go on to the next problem. Good luck

For the following problems VDD=VCC=10V.

For the npn transistors: $\beta = 99$, VA=100V, $C_\pi = 20$pFd, $C_\mu = 0$; bias VBE=0.7

For the NMOS transistors: KP=$4\text{x}10^{-4}$, VTO=1, LAMBDA=0.01, W/L=1

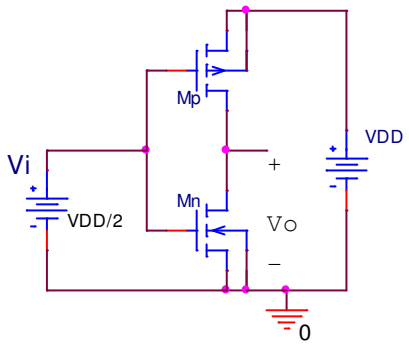
For PMOS transistors: KP=$2\text{x}10^{-4}$, VTO=-1, LAMBDA=0.01, W/L depends on problem

1. (30 points, 20 min)

a) Give the value of W/L needed for Mp such that Vo = Vi

b) Find numerically the range of Vo for which both transistors are in saturation.

c) From b) find numerically the range of W/L of Mp for which both transistors are in saturation.



2. (25 points, 15 min)

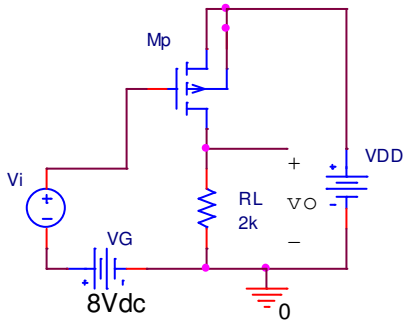
For the following circuit assume that W/L (=2*125/27) is chosen such that Vo is biased to Vo = 2V

a) Give numerically the transistor's source current IS, gm and go.

b) Draw the small signal equivalent circuit including Cgs &Cgd using generic symbols (= without numerical values).

c) Find (without numerical values) the small signal voltage gain, vo/vi(s) and give its poles and zeros.

d) Evaluate numerically the poles and zeros when Cgs=Cgd=5pFd.



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3. (45 points, 25 min)

The following two circuits are identical except that one uses a BJT and the other a MOSFET (and possibly different Rb).

Note that the bias current sources have the value of 2mA with 3V across them (held by the bypass capacitors to give VS=VE=3).

Assume that the coupling and bypass capacitances, Ci and Cbp, are extremely large and Cbp always holds its initial voltage of 3V.

a) Find the bias voltages Vo (with respect to ground) and compare,

b) Find the resistor, Rb, values to obtain the desired bias.

c) Find the gm for both and compare; do the same for go. .