ECE 2C Circuits, Devices and Systems

Midterm Exam Sample#2

Instructor: Prof. C. Patrick Yue

Name: _____

- **You have 1 hour and 15 min. to complete this quiz.**
- **Closed book, one 8.5"x11" equation sheet allowed.**
- **Calculators are allowed.**
- **Please turn off and put away your mobile phone**
- **Be sure to include the proper units in your answers.**
- **State all of your assumptions in your solutions in order to receive partial credits for incorrect answers.**
- **To receive credit, there must be sufficient evidence of your reasoning. Correct answers without correct reasoning or clear calculation steps will not receive full credits.**

Problem 1 _____ / 50 (DC analysis PMOS circuits)

Problem 2 _____ / 50 (Frequency response of a NMOS amplifier)

Total _____ / 100

Problem 1 (Total 50 pt.)

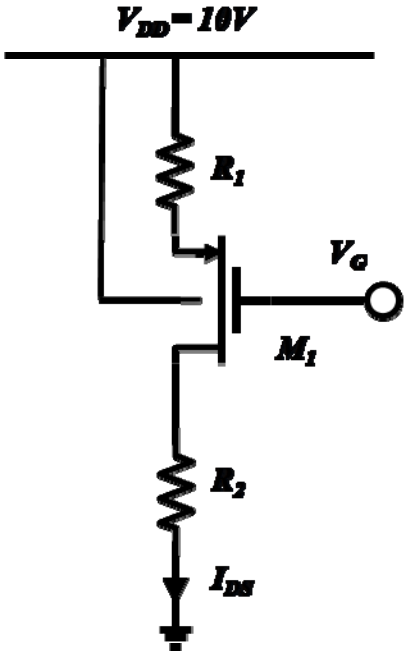
Given: $0.5\mu CoxW/L = 50\ mA/V^2$, $V_t = -1\ V$, *and* $\gamma = 0$.

For $\lambda=0$:

(a) Find V_{SG} to set I_{DS} = 25 mA. (10 pt.)
(b) If R_1 = 100 Ω, find V_G. (10 pt.)
(c) Find the max. value of R_2 to keep M_1 in saturation region. (10 pt.)

For $\lambda=0.1$:

(d) Use R_1 = 100 Ω and R_2 = 200 Ω. If V_G = 6 V, find the new I_{DS}. (20 pt.)



Problem 2 (Total 50 pt.)

Given: $\lambda = 0$ *and* $\boldsymbol{\gamma \neq 0}$.

(a) Find the expression for the small-signal midband voltage gain, v_{out}/v_{in}. (10 pt.)
(b) Find the lower –3dB corner frequency (10 pt.)
(c) Find the upper –3dB corner frequency (10 pt.)
(d) Write down the overall expression of $v_{out}/v_{in}(s)$. (10 pt.)
(e) Sketch the Bode plot of $v_{out}/v_{in}(s)$. (10 pt.)