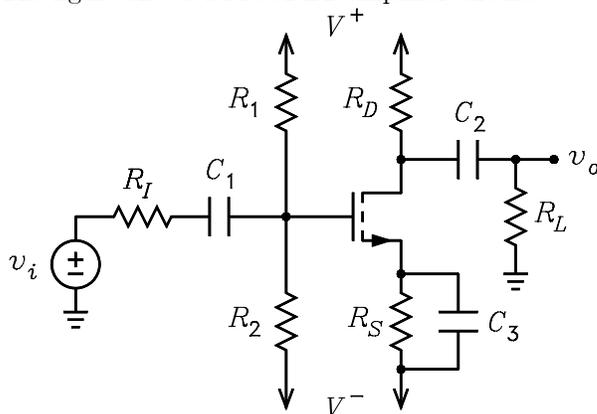**ECE 3040 Quiz 5 – June 22, 2005**

Professor Leach   Name_____

Instructions. Print your name in the space above. The quiz is closed-book and closed-notes. The quiz consists of 2 problems. **Honor Code Statement:** *I have neither given nor received help on this quiz.* Initials _____

1. The figure shows a MOSFET amplifier circuit.

(a) What is the circuit called? Common-source amplifier.
(b) What is the purpose of each capacitor in the circuit? C_1 is an input dc blocking capacitor. C_2 is an output dc blocking capacitor. C_3 provides an ac short circuit across R_S to increase the voltage gain of the circuit.
(c) Is the voltage gain inverting or non-inverting? Inverting
(d) In the dc bias circuit, solve for the expressions for V_{GG}, R_{GG}, V_{DD}, R_{DD}, V_{SS}, and R_{SS}.

$$V_{GG} = \frac{V^+ R_2 + V^- R_1}{R_1 + R_2} \qquad R_{GG} = R_1 \| R_2$$
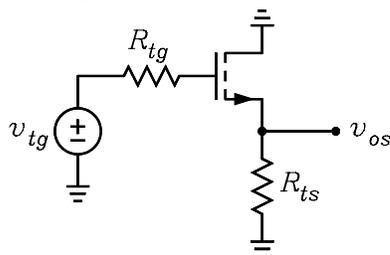
$$V_{DD} = V^+ \qquad R_{DD} = R_D$$

$$V_{SS} = V^- \qquad R_{SS} = R_S$$

(e) One of the equations required to solve for I_D is a loop equation. Write, but do not solve, this equation.

$$V_{GG} - V_{SS} = V_{GS} + I_D R_{SS}$$

2. The signal equivalent circuit of a MOSFET is shown.

(a) What is the circuit called? Common-drain amplifier.
(b) In the small-signal analysis of MOSFET amplifiers, what is the general rule for r_0 if writing node equations are to be avoided? Omit r_0 if neither the drain or source connect to signal ground.
(c) Redraw the circuit with the MOSFET replaced with the appropriate version of the pi model. See the Class Notes.

(d) Use the pi model circuit to write the equations necessary to solve for v_{os}/v_{tg}. Solve the expression for v_{os}/v_{tg}.

$$\frac{v_{os}}{v_{tg}} = \frac{g_m R_{ts} \| r_0}{1 + g_m R_{ts} \| r_0}$$