ECE3110 **Homework #1** **Fall 2005**

(due Aug. 31)

1. A source with an internal voltage of v_s=1mV rms and an internal resistance of R_s=1kΩ is connected to the input terminal of an amplifier having an open-circuit voltage gain of A_{vo}=100 V/V, an input resistance of R_i=2MΩ and an output resistance of R_o=10Ω. There is a load resistance of R_L=8Ω.

   a. Find the voltage gain $A_v = v_o/v_i$ and the overall voltage gain $A_{vs}=v_o/v_s$
   b. Find the current gain
   c. Find the power gain
   d. If R_i=1kΩ now and keeping everything else the same, calculate A_{vs}.

   Express all the gains as ratios and in dB.

2. A source with an internal voltage of v_s=100mV rms and an internal resistance of R_s=100kΩ is connected to the input terminal of an amplifier having a gain of A_{is}=100 A/A, an input resistance of R_i=1kΩ and an output resistance of R_o=1kΩ. There is a load resistance of R_L=1kΩ.

   a. Find the current gain i_o/i_i
   b. Find the voltage gain v_o/v_s
   e. Find the power gain

   Express all the gains as ratios and in dB.

3. A transconductance amplifier with G_m=80 mA/V, R_i=10kΩ, and R_o=100kΩ has a voltage source attached at the input with source resistance, R_s=5kΩ , and a load resistance of R_L=1kΩ. Find the voltage gain.

4. An n-channel enhancement MOSFET is operating in the saturation region. It has V_t=1V and $k_n'(W/L)$=0.5mA/V^2. If i_D=1mA, find the required v_{GS} and the minimum required v_{DS}. Repeat for i_D=0.3mA. Ignore λ.

5. Use Fig. P4.77 in your book. Ignore r_o. If V_t=1V and $k_n'(W/L)$=1mA/V^2, find R_{in}, v_{gs}/v_{sig}, v_o/v_{gs}, and v_o/v_{sig}.

6. Use Fig. P5.79. Analyze all the circuits using β=50. Find all labeled node voltages and branch currents.

7. Use the circuit for a common-emitter amplifier shown in Fig. 5.60(a). The circuit is biased to operate with I_C=0.5mA. R_C=20kΩ, β=100, R_{sig} = 1kΩ, R_L = 1kΩ. Assume R_B is infinite and all capacitors are large. Find R_{in}, the overall voltage gain $A_v=v_o/v_{sig}$, and R_{out}. Ignore r_o.