University of Oulu
Electronics laboratory

Principles of electronic design (52431A)
Exam 6/19/2004

1. a) Amplifier models. Draw four different amplifier models (voltage amplifier, current amplifier, transconductance and transresistance models). Which factors determine, which model to use?
   b) What kind of amplifier is a differential amplifier? What benefits does one get from the differentiality? What does the term CMRR mean?

2. Consider the amplifier shown in Figure 1.
   a) What are the numerical values of DC currents I_D and I_G?
   b) Calculate the small signal parameter g_m of the MOS transistor and draw the small signal model of the amplifier, when the value of capacitor C is very large ($\approx \infty$), the MOS is assumed to stay in saturation and the output resistance r_o of the MOS is not concidered.
   c) What is the small signal (i.e. ac) gain v_{out}/v_{in} of the circuit?

3. Draw a schematic of a 3-bit flash-type AD-converter for an input voltage range of +/- 1V. Use operational amplifiers.

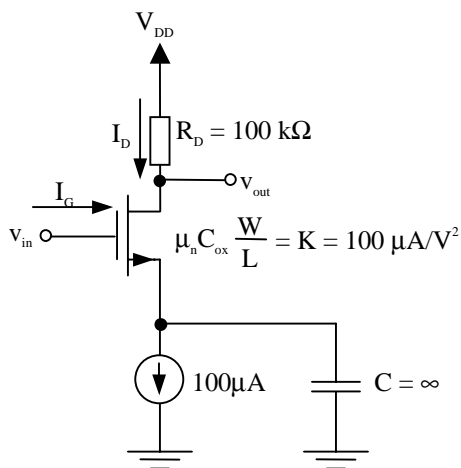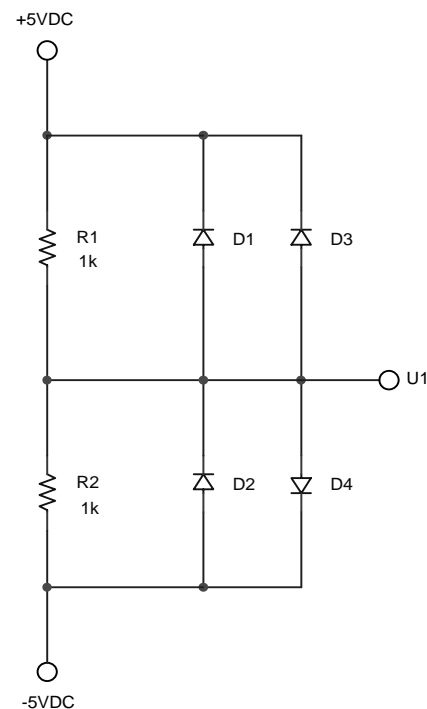4. Determine voltage U1 and diode currents in Figure 2. Assume diodes as ideal.

Figure 1.

Figure 2.