Electronics II
Problem sheet 3

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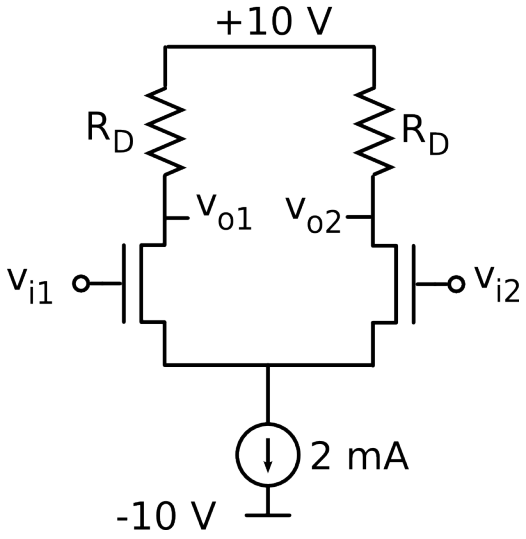
MIEET 3º ano



1:

The figure above shows a differential pair based on FETs with a current source of 2 mA that has an output resistance of 200 kΩ. The FET-parameters are: $K = \mu C_{ox} W/L = 2$ mA/V^2 and $V_T = 0$. $R_D = 5$ kΩ.
a) Calculate the bias point of the circuit.
b) Calculate the common-mode gain, A_{cm}, the differential-mode gain A_{dm}, and the CMRR.
c) Calculate the inpute resistance r_{in} and output resistance r_{out} of the circuit.

FET:
$I_D = K\,(V_{GS}-V_T)V_{DS}$ (linear)
$I_D = K/2\,(V_{GS}-V_T)^2$ (saturation)

2:

In the theoretical lectures we found a relation between the input signal difference (V_1 e V_2) and the output currents (I_{E1} e I_{E2}) for large signals (Ebers-Moll) for a differential pair based on bipolar transistors. The conclusion there was that the output signal is linear proportional to the input signal difference until about 3 times V_T, in other words about 75 mV.
Repeat the calculations for a differential based on FETs.
(Difficult! You can use electronics simulators such as SPICE or Workbench)