Problem 1

You are given a CS amplifier and NMOS device parameters shown below. The current source supply provides 100µA and has an infinite output resistance, (i.e. ISUP = 100 µA and roc → ∞). The current source supply must have at least 0.5 V across it in order to maintain the high output resistance.

\[
\begin{align*}
W/L &= 150/1.5 \\
V_{Th} &= 0.5 \text{ V} \\
\mu_nC_{ox} &= 50 \mu\text{A/V}^2 \\
\lambda_n &= 0.067 \text{ V}^{-1} @ L = 1.5 \mu\text{m}
\end{align*}
\]

a) Calculate \(V_{BIAS}\) such that \(V_{OUT} = 0 \text{ V}\).

b) Draw the two-port model and calculate the two-port parameters \(R_{in}\), \(R_{out}\), and \(A_v\).

c) Calculate the overall voltage gain \(v_{out}/v_s\).

d) Calculate the output voltage swing.
Problem 2

You are given a CE amplifier and NPN device parameters shown below. The current source supply provides 250µA and has an output resistance equal to $r_o$ of the NPN (i.e. $I_{SUP} = 250\mu A$ and $r_{oc} = r_o$). The current source supply must have at least 0.5V across it in order to maintain the high output resistance.

![Diagram of CE amplifier](image)

\[ I_s = 10^{-15} \text{ A} \]
\[ \beta_F = 100 \]
\[ V_A = 25 \text{ V} \]

a) Calculate $V_{BIAS}$ such that $V_{OUT} = 0 \text{ V}$.

b) Draw the two-port model and calculate the two-port parameters $R_{in}$, $R_{out}$, and $A_v$.

c) Calculate the overall voltage gain $v_{out}/v_s$.

d) Calculate the output voltage swing. Assume $V_{CEsat} = 0.2 \text{ V}$.

Problem 3

Howe and Sodini P8.30

Problem 4

Howe and Sodini P8.39, $V_{TON} = 0.7 \text{ V}$
6.012 Microelectronic Devices and Circuits
Spring 2009

For information about citing these materials or our Terms of Use, visit: http://ocw.mit.edu/terms.