

Analog & Digital VLSI Design

EEE/INSTR F313

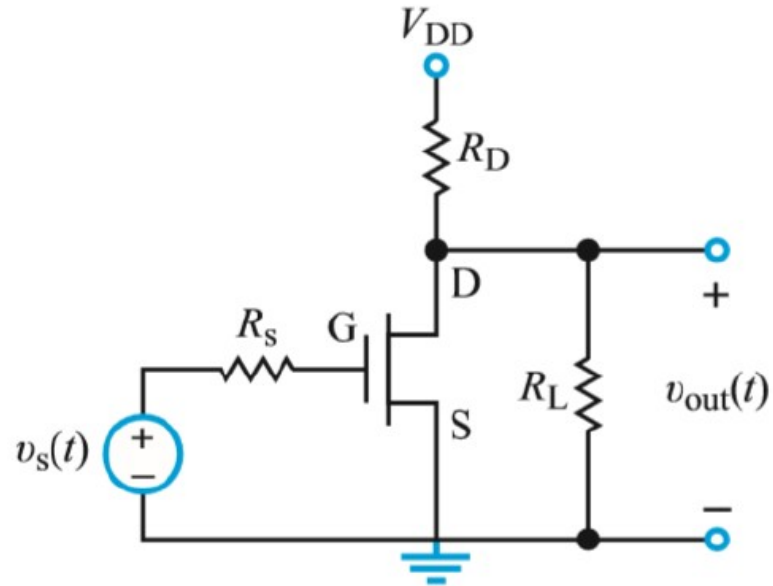
Dept. of Electrical & Electronics Engineering (EEE)

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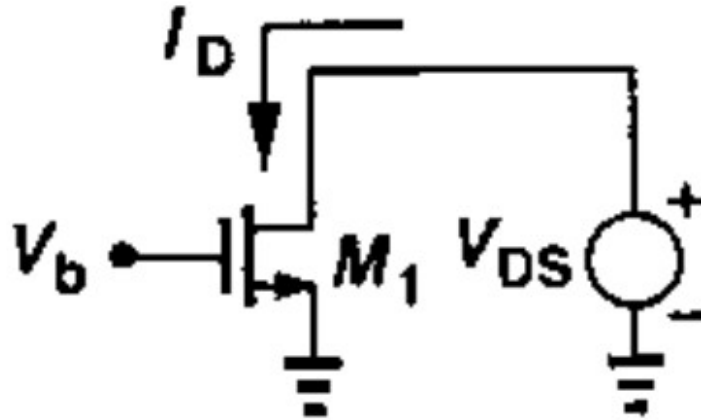
Problem 01

Obtain an expression for V_{OUT} as a function of V_{S} .



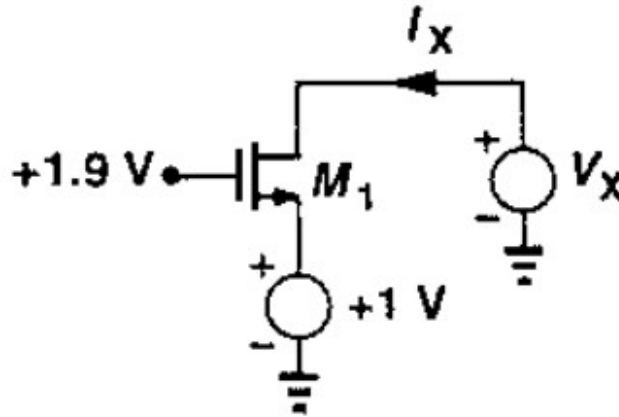
Problem 02

Plot the transconductance g_M as a function of V_{DS} .



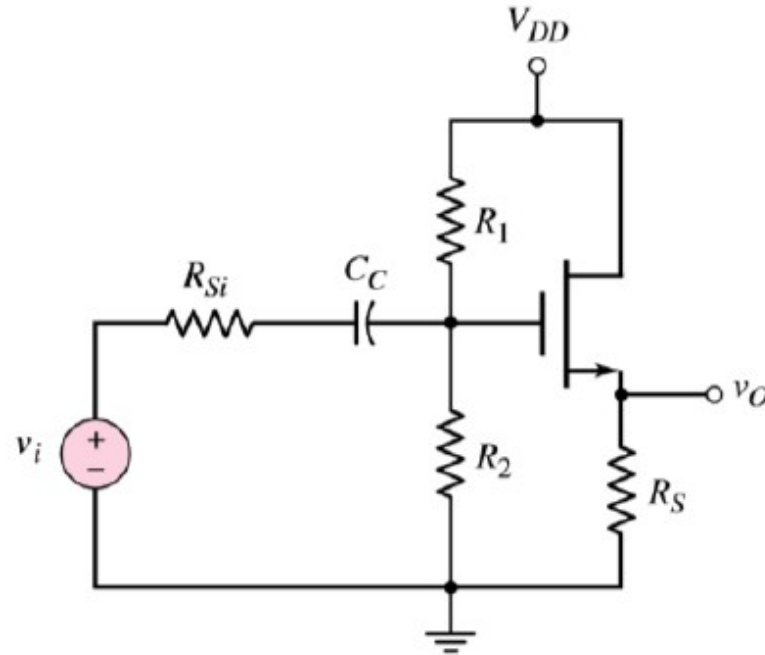
Problem 03

Sketch I_X and transconductance of the transistor as a function of V_X for the circuit below. V_X varies from 0 to V_{DD} . Assume $V_T=0.7$ V, $\lambda=0$ and $\gamma=0$.



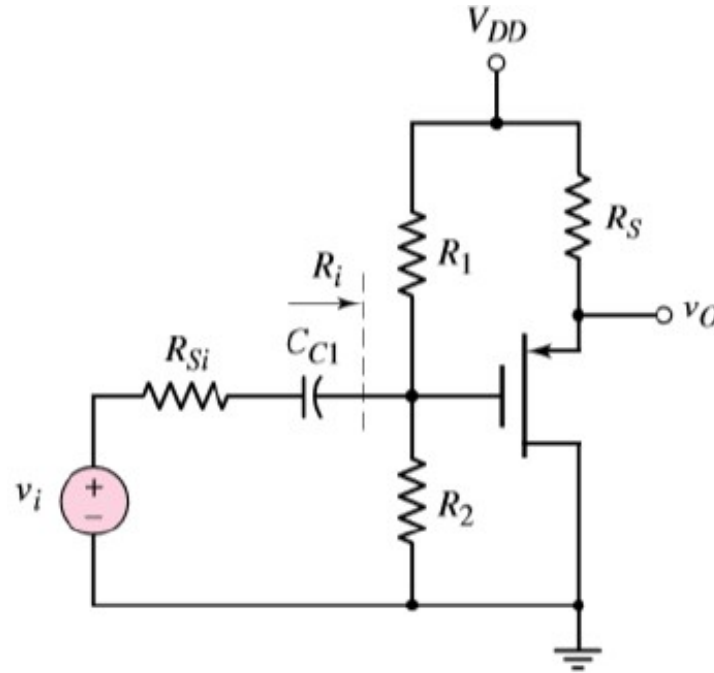
Problem 04

Calculate the small signal voltage gain and output resistance of circuit. Given: $V_{DD}=12\text{ V}$, $R_1=162\text{ k}\Omega$, $R_2=463\text{ k}\Omega$, $R_S=0.75\text{ k}\Omega$, $R_{SIG}=4\text{ k}\Omega$, $V_T=1.5\text{ V}$, $k=0.5\text{ mA/V}^2$, $\lambda=0.01\text{ /V}$.



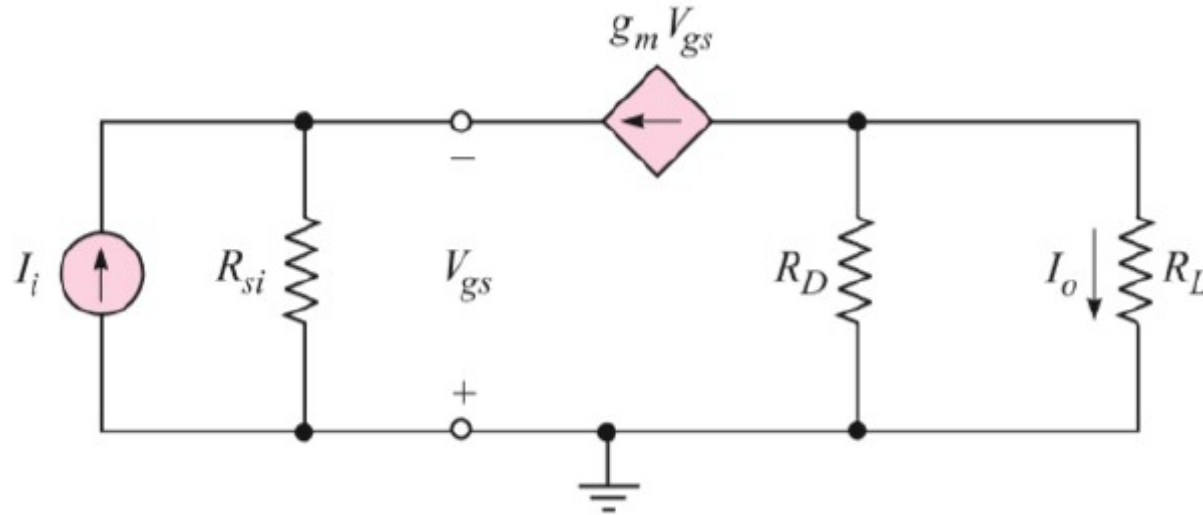
Problem 05

Given: $V_{DD}=20$ V, $V_T=-2$ V, $K'=40$ $\mu\text{A}/\text{V}^2$, $\lambda=0$, $R_{SIG}=4$ k Ω . Design a circuit such that $V_{SDQ}=20$ V, $I_{DQ}=2.5$ mA, $R_{IN}=50$ k Ω , and the transistor (W/L) ratio is such that the small signal voltage gain is $A_v=0.9$ V/V.



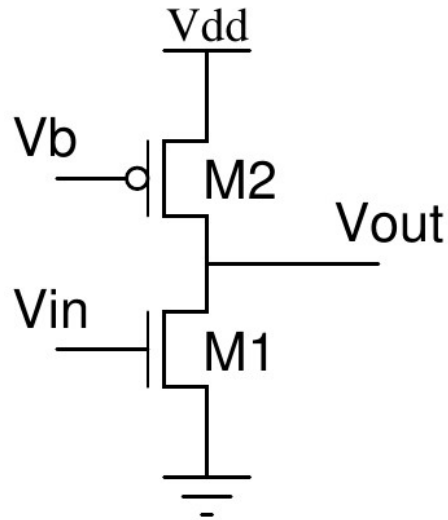
Problem 06

Determine the output voltage gain for a given input current. Given: $I_Q=1$ mA, $V_+=5$ V, $V_-=-5$ V, $R_G=100$ k Ω , $R_D=4$ k Ω , and $R_L=10$ k Ω , $V_T=1$ V, $K=1$ mA/V², $\lambda=0$, and the input current is $100\sin(\omega t)$ μ A.



Problem 07

In the circuit assume $(W/L)_1=50/0.5$, $(W/L)_2=50/2$, and $I_{D1}=I_{D2}=0.5$ mA when both the devices are in saturation. Calculate the small-signal voltage gain and the maximum output signal swing while both the devices are saturated. Given: $\mu_N C_{OX}=1.34 \times 10^{-4}$ A/V², $\mu_P C_{OX}=3.835 \times 10^{-5}$ A/V², $\lambda_N=0.1$, $\lambda_P=0.2$, $V_{DD}=3$ V.



Problem 08

Assuming $V_{DD}=1.8\text{ V}$, $|V_T|=0.5\text{ V}$, $V_{OV}=0.2\text{ V}$, $r_{O1}=r_{O2}=r_O$, estimate the absolute voltage gain of circuit. Ignore the body effect.

