

Analog & Digital VLSI Design

EEE/INSTR F313

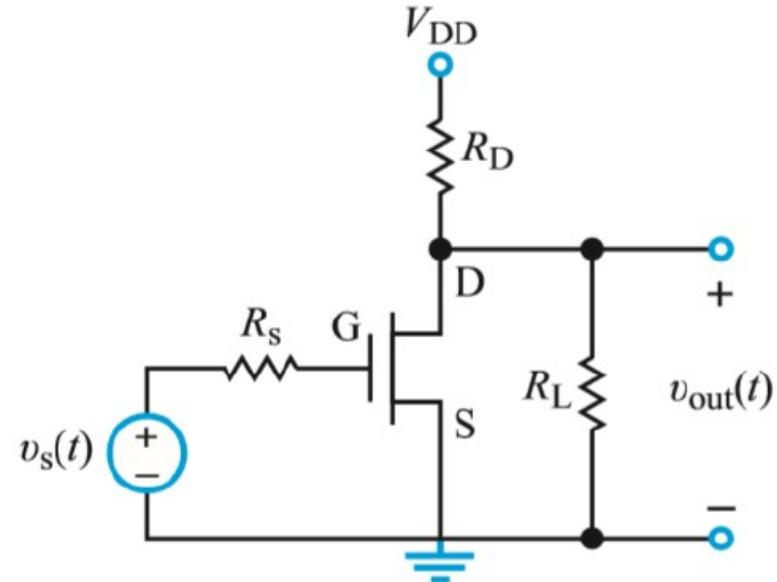
Dept. of Electrical & Electronics Engineering (EEE)

Birla Institute of Technology & Science (BITS) Pilani

Hyderabad Campus

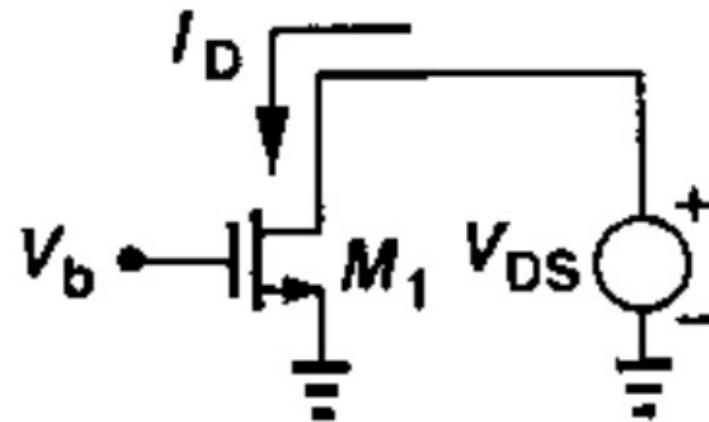
Problem 01

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



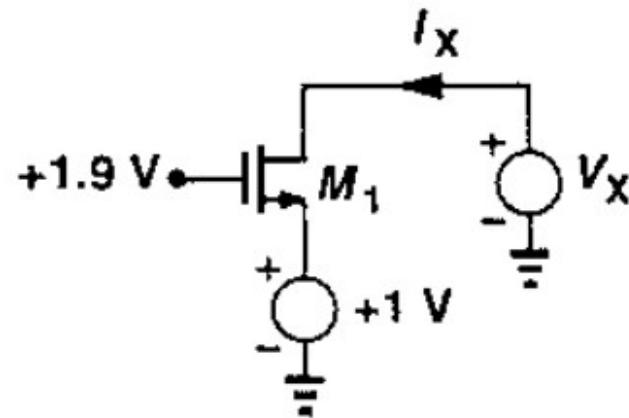
Problem 02

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



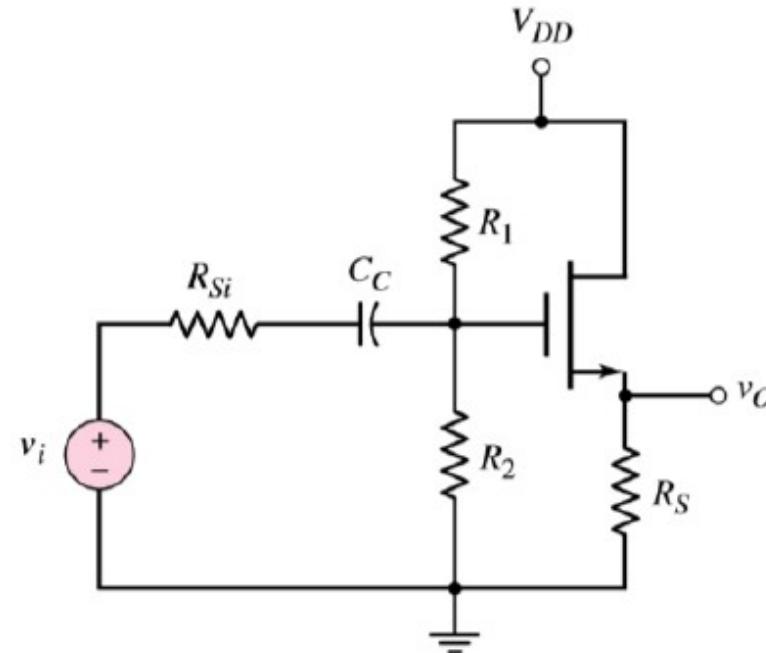
Problem 03

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 $\gamma=0$.



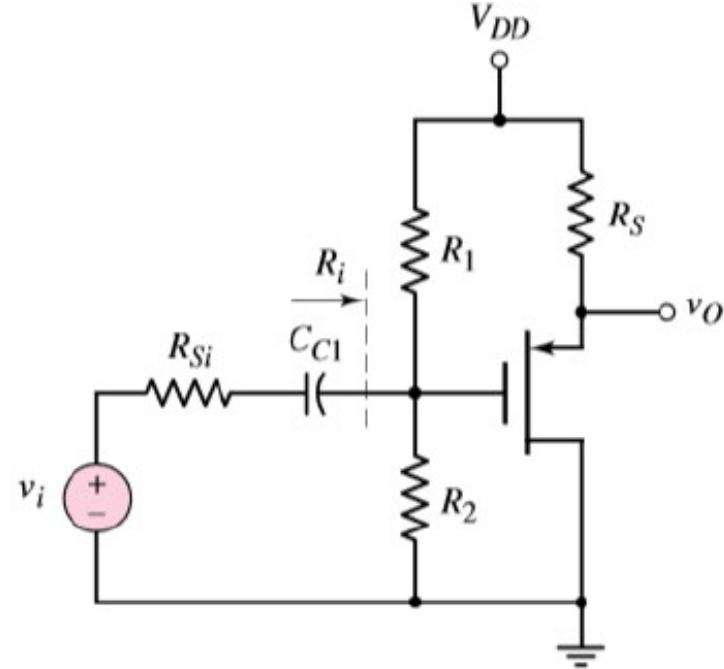
Problem 04

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



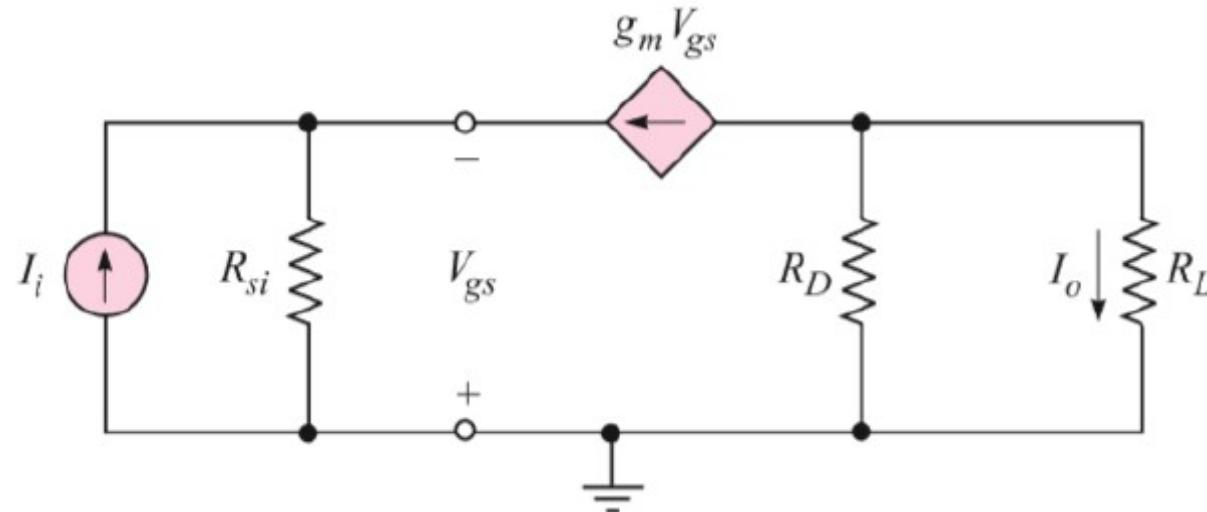
Problem 05

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



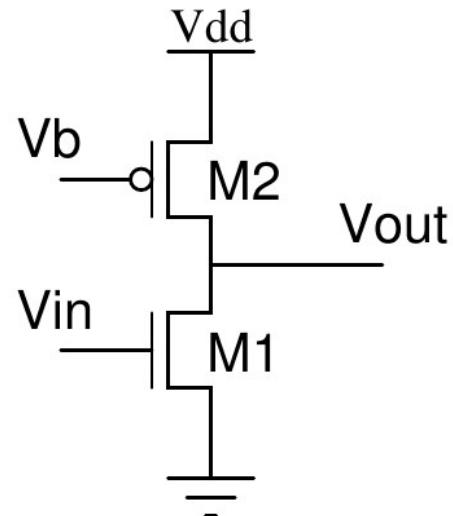
Problem 06

Determine the output voltage gain for a given input current. Given: $I_Q=1 \text{ mA}$, $V_+=5 \text{ V}$, $V_-=-5 \text{ V}$, $R_G=100 \text{ k}\Omega$, $R_D=4 \text{ k}\Omega$, and $R_L=10 \text{ k}\Omega$, $V_T=1 \text{ V}$, $K=1 \text{ mA/V}^2$, $\lambda=0$, and the input current is $100\sin(\omega t) \mu\text{A}$.



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 $V_{DD}=1.8$ V, $|V_T|=0.5$ V, $V_{ov}=0.2$ V, $r_{o1}=r_{o2}=r_o$, estimate the absolute voltage gain of circuit. Ignore the body effect.

