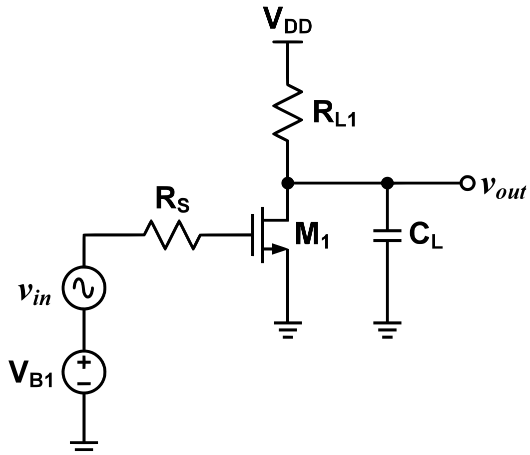
Assignment: #2

Due Date and Time: Feb. 17, 2020, 11:59PM

PROBLEM 1. Common Source (CS) Amplifier



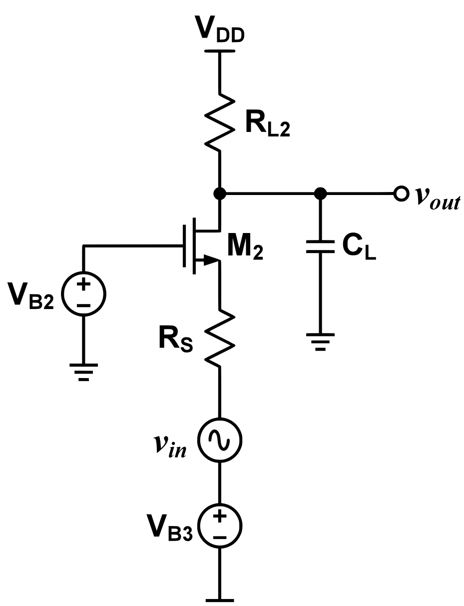
Given: V_{DD} = 1.3V, R_S = 50Ω, R_{L1} = 0.9kΩ and C_L = 1pF. The operating points of M_1 are as follows: I_d = 1mA, g_m = 8.2mA/V, g_{ds} = 0.3mA/V, g_{mb} = 2.2mA/V, C_{gs} = 31fF, C_{gd} = 14fF, C_{gb} = 1fF, C_{db} = 28fF, C_{sb} = 31fF. Bulk of M_1 is grounded.

(a) Draw the small signal equivalent model of the above CS amplifier and find $v_{out}(s)/v_{in}(s)$.

(b) Find DC Gain, poles and zeroes of the transfer function. Use approximations as necessary.

(c) Plot the magnitude and phase of $v_{out}(s)/v_{in}(s)$ with and without the approximations.

PROBLEM 2. Common Gate (CG) Amplifier



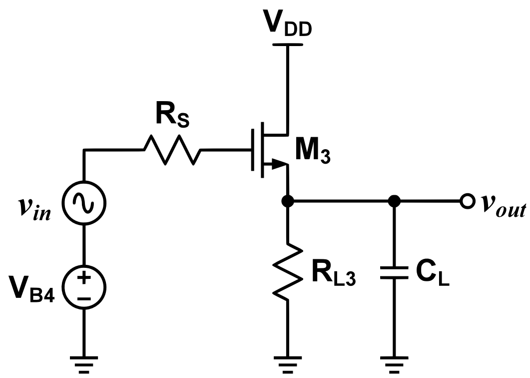
Given: V_{DD} = 1.3V, R_S = 50Ω, R_{L2} = 0.8kΩ and C_L = 1pF. The operating points of M_2 are as follows: I_d = 1mA, V_{ds} = 0.9V, g_m = 8mA/V, g_{ds} = 0.3mA/V, g_{mb} = 2.1mA/V, C_{gs} = 30fF, C_{gd} = 13fF, C_{gb} = 0.8fF, C_{db} = 26fF, C_{sb} = 29fF. Bulk of M_2 is grounded.

(a) Draw the small signal equivalent model of the above CG amplifier and find $v_{out}(s)/v_{in}(s)$.

(b) Find DC Gain, poles and zeroes of the transfer function. Use approximations as necessary.

(c) Plot the magnitude and phase of $v_{out}(s)/v_{in}(s)$ with and without the approximations.

PROBLEM 3. Source Follower



Given: $V_{DD} = 1.3V$, $R_S = 50\Omega$, $R_{L3} = 0.5k\Omega$ and $C_L = 1pF$. The operating points of M_3 are as follows: $I_d = 1mA$, $g_m = 7.4mA/V$, $g_{ds} = 0.3mA/V$, $g_{mb} = 1.8mA/V$, $C_{gs} = 25fF$, $C_{gd} = 11fF$, $C_{gb} = 0.4fF$, $C_{db} = 21fF$, $C_{sb} = 23fF$. Bulk of M_3 is grounded.

(a) Draw the small signal equivalent model of the above source follower and find $v_{out}(s)/v_{in}(s)$.

(b) Find DC Gain, poles and zeroes of the transfer function. Use approximations as necessary.

(c) Plot the magnitude and phase of $v_{out}(s)/v_{in}(s)$ with and without the approximations.