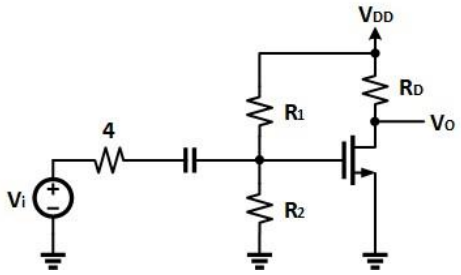
HW5

1)

Proof that π-model is equivalent to T-model (MOSFET). (Neglect channel length modulation)

2)

For the circuit as shown, the parameters are: V_{DD} = 10V, R_1 = 70.9kΩ, R_2 = 29.1kΩ, and R_D = 5kΩ. The transistor parameters are: V_{tn} = 1.5V, k_n = 0.5mA/V^2, and λ = 0.01V^{-1}. Determine the small-signal voltage gain, input resistance, and output resistance of the common-source amplifier.



3)

A CS amplifier utilizes a MOSFET with $\mu_n C_{ox}$ = 400 μA/V^2 and W/L=10. It is biased at I_D = 320 μA and uses R_D = 10kΩ. Find R_{in}, A_V, and R_o. Also, if a load resistance of 10kΩ is connected to the output, what overall voltage gain A_V is realized? Now, if a 0.2-V peak sine-wave signal is required at the output, what must the peak amplitude of v_{sig} be?

4)

A common-source amplifier utilizes a MOSFET operated at V_{OV} = 0.25 V. The amplifier feeds a load resistance R_L = 15kΩ. The designer selects $R_D = 2R_L$. If it is required to realize an overall voltage gain A_V of −10 V/V what g_m is needed? Also specify the bias current I_D. If, to increase the output signal swing, R_D is reduced to $R_D = R_L$, what does A_V become?