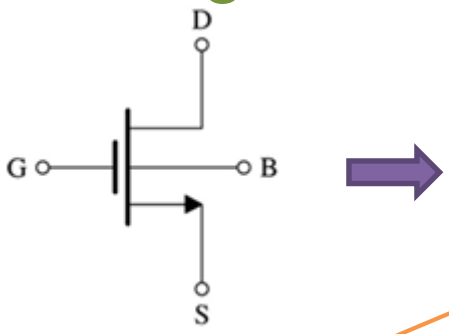
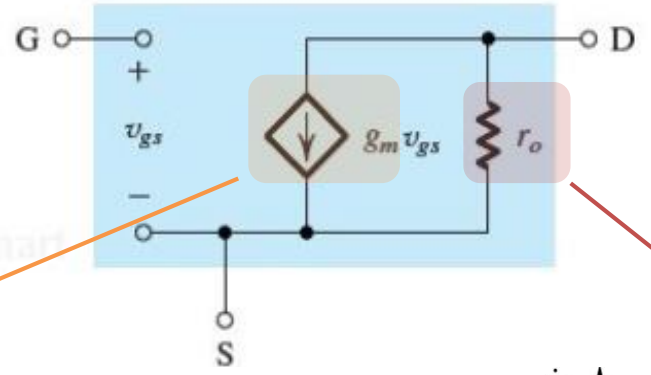
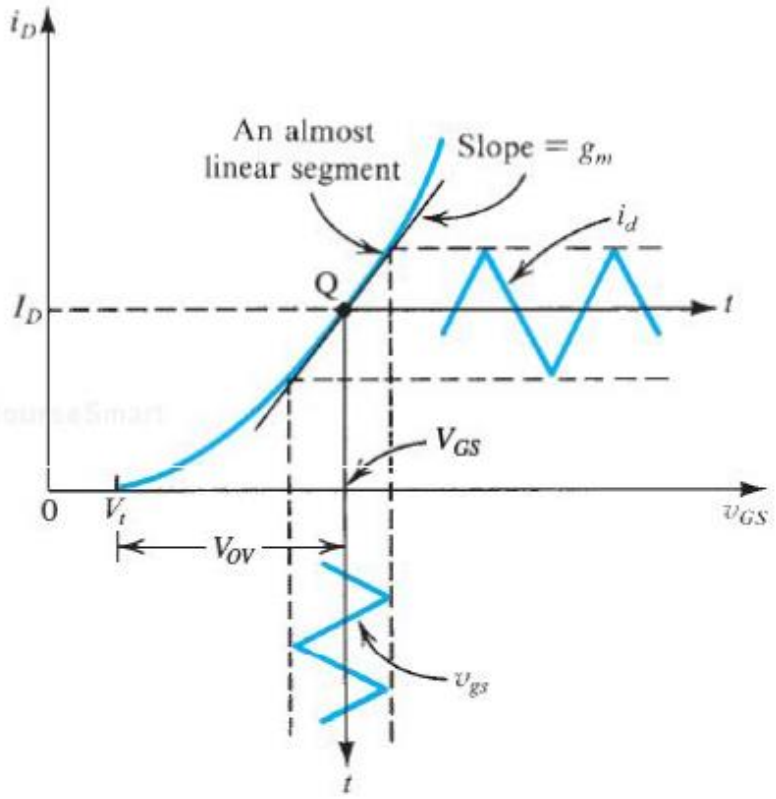
Last Lecture → MOS Small Signal Circuit

→ Trans-conductance (g_m)
→ Output Impedance (r_o)
→ Input Impedance



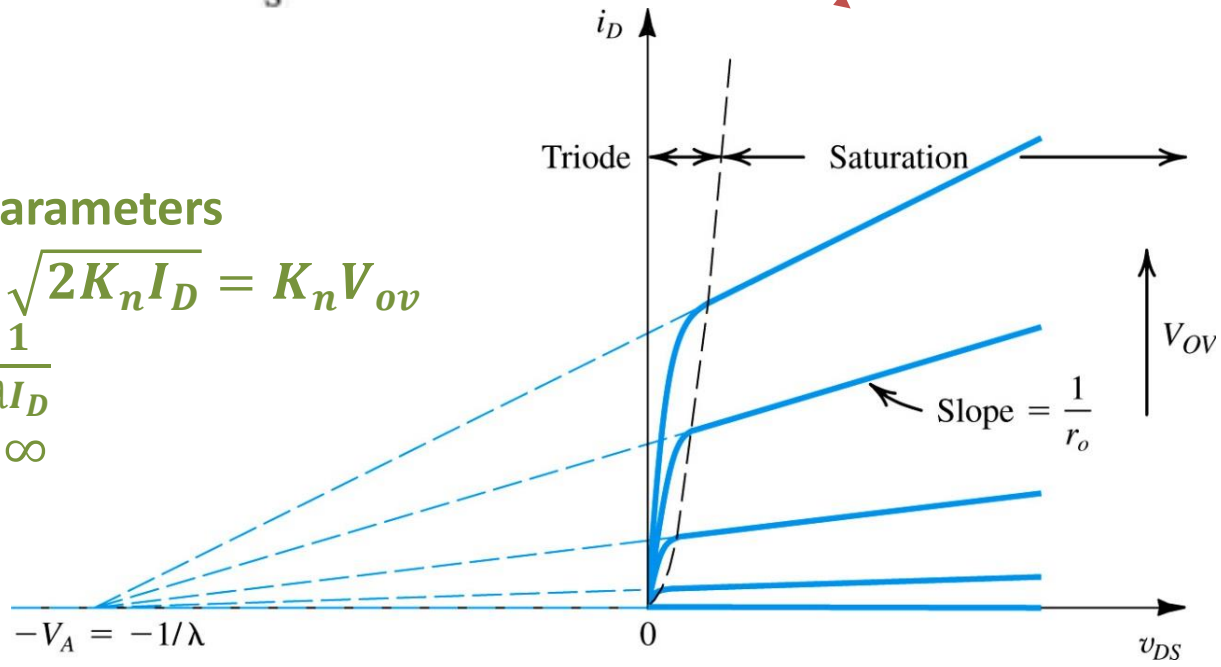
$V_{BS} = 0$



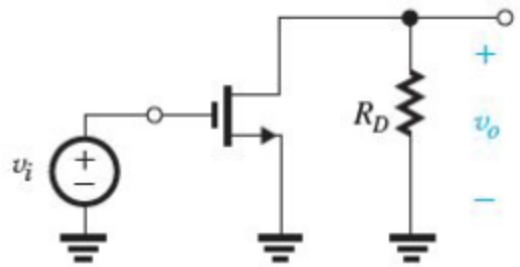


Small Signal Parameters

- $g_m = \sqrt{2K_n I_D} = K_n V_{ov}$
- $r_0 = \frac{1}{\lambda I_D}$
- $r_{in} = \infty$



Basic MOSFETs Amplifier Configuration

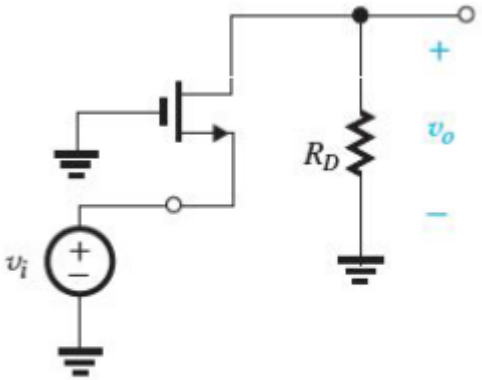


(a) Common Source (CS)

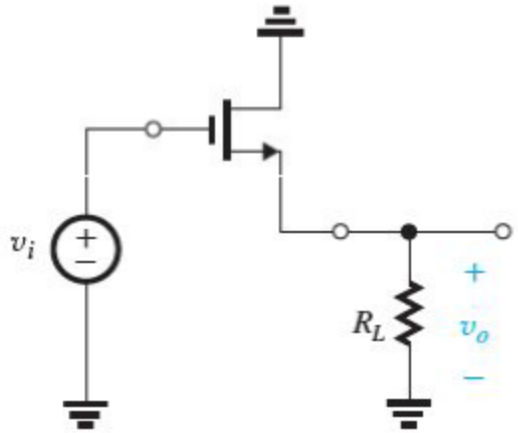
Exercise 5.38

Consider the given common source amplifier with g_m=1mA/V, r_0=150kΩ, R_{sig}=100kΩ, and R_L=15kΩ.

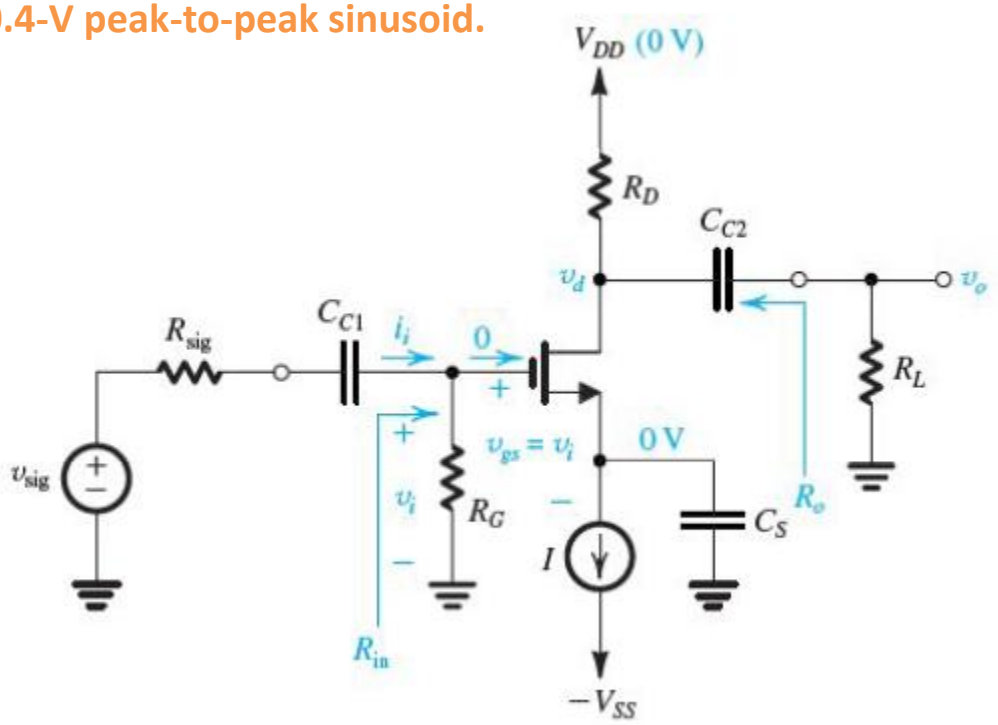
a) Calculate R_{in}, $A_{v\_cs}=V_0/V_i$, and R_0, both without and with r_0 taken into account
b) Calculate the overall voltage gain $G_v=v_0/v_{sig}$, with r_0 taken into account
c) Determine output signal v_0 if v_{sig} is a 0.4-V peak-to-peak sinusoid.



(b) Common Gate (CG)



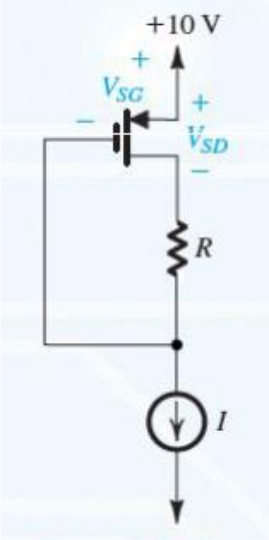
(c) Common Drain (CD)



Problem 5.58

For the PMOS transistor in the circuit shown below, assume K_p=200µA/V^2, and $|V_{tp}|$=1V.

1) **For I=100µA, find the voltages V_{SD} and V_{SG} for R=0, 10KΩ, 30KΩ, and 100kΩ.**
2) **For what value of R is V_{SD}=V_{SG}? V_{SD}=V_{SG}/2? V_{SD}=V_{SG}/10?**



Problem

In the circuit shown below, transistor Q_1 and Q_2have V_t=1V, and the process trans-conductace parameter k_n'=100µA/V2. Find V_1, V_2, and V_3 for each of the following cases:

a) $(W/L)_1 = (W/L)_2 = 20$

b) $(W/L)_1 = 1.5\cdot(W/L)_2 = 20$