King Fahd University of Petroleum & Minerals
Electrical Engineering Department
Winter 2012 (112)

EE 203 – Exam II
Wednesday, April 18, 2012
6:00-7:30 PM

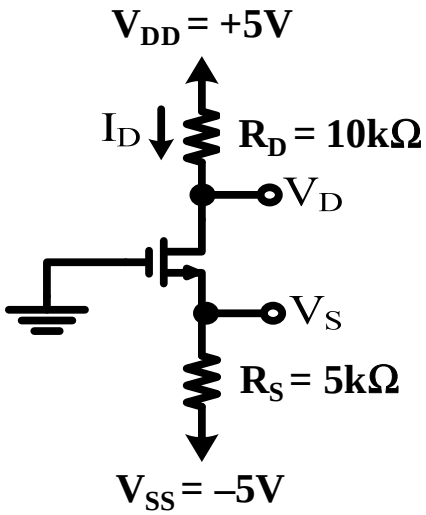
Name	
ID	

	Dr. M. Al-Gahtani	Dr. H. Al-Zaher	Dr. O. Hammi	Dr. W. Mesbah	Dr. H. Ragheb
Section	3 and 6	5	1, 4 and 8	7	2

Problem	**Grade**
1 (12 points)	
2 (12 points)	
3 (6 points)	
Total (30 points)	

Problem 1 - A:
For the circuit below, assuming the MOSFET operates in saturation (pinch off) mode and has V_t=2V and $\mu_n C_{ox} W/L$=0.8mA/V^2.

a) Determine I_D, V_D, and V_S. **[5 points]**
b) Verify the assumption on the transistor's mode of operation. **[1 points]**

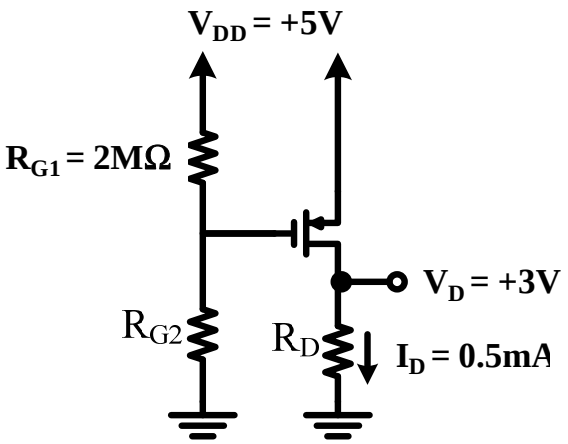


Problem 1 - B:

Design the below so that the MOSFET operates in saturation (pinch off) mode with I_D=0.5mA and V_D=3V. The MOSFET has V_t= –1V and k_pW/L=1mA/V^2 .

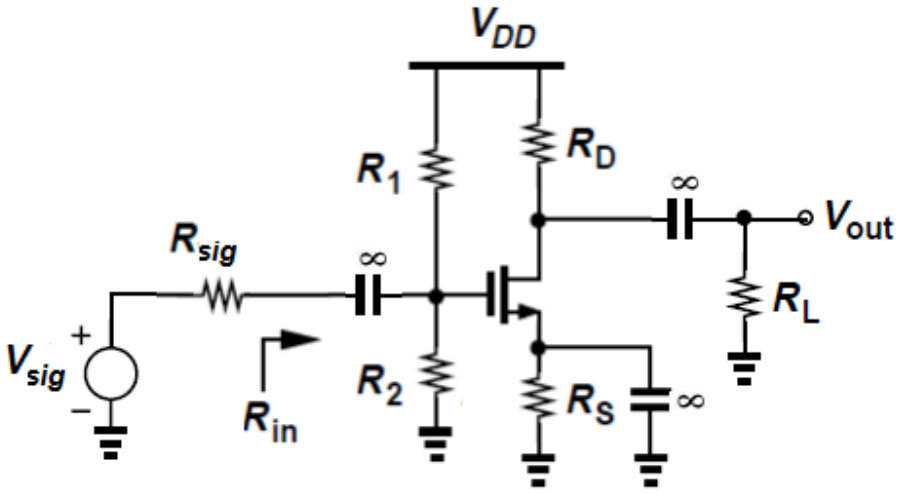
a) Given that R_{G1}=2MΩ, find the values of R_{G2} and R_D. **[4 points]**

b) Find R_D such that the transistor will work at the edge of saturation (pinch off). **[2 points]**



Problem 2 - A:
For the circuit shown below, the NMOS transistor operates into saturation (pinch off) mode. The transistor has channel length modulation ($\lambda \neq 0$)

a) What type of amplifiers is this? **[2 points]**
b) Draw the small-signal equivalent model for the whole circuit using the small signal π-model. **[4 points]**



Problem 2 - B:

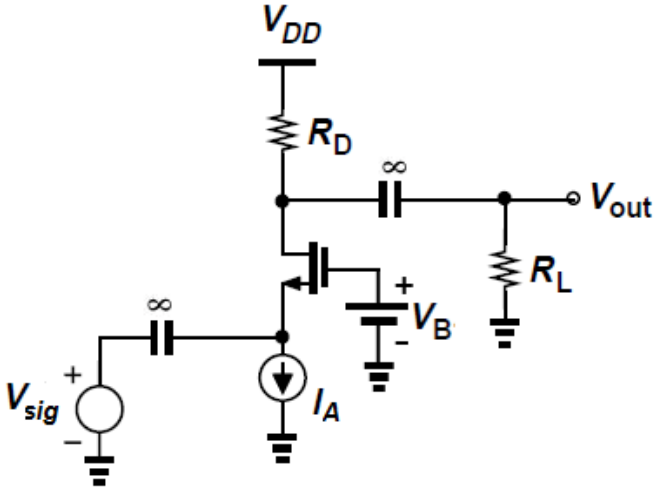
For the amplifier circuit shown below, $\lambda=0$, $I_A=1mA$, $V_{tn}=1V$, and $k_nW/L=2mA/V^2$.

a) What type of amplifiers is this? **[1 point]**

b) Calculate the amplifier transconductance (g_m). **[2 points]**

c) Derive the expression of the overall voltage gain (v_{out}/v_{sig}) **[3 points]**

Note that v_{sig} is an AC source and all other sources are DC.



Problem 3:

The transistor in the circuit below has $\beta=100$ and $V_{BE}(on)=0.7V$.

a) Find I_E, I_C, V_E and V_C? Start the analysis by assuming that the transistor works in the active mode. **[4 points]**

b) Verify the mode of operation of the transistor. **[2 points]**