EE 315 Module 4 Practice Problems

1. An NMOS transistor is characterized as follows: V_{DS}=0.1V, V_t=1.5V, k'_n= 25 $\mu A/V^2$, and W/L = 10. Find the drain current for V_{GS}=0V, 1V, 2V, and 3V.

2. An NMOS transistor is characterized as follows: V_{DS}=3.3V, V_t=1.V, k'_n= 37.5 $\mu A/V^2$, and W/L = 10. Find the drain current for V_{GS}=0V, 1V, 2V, and 3V.

3. Identify the region of operation and the drain current for an NMOS transistor where the k'_n= 25 $\mu A/V2$, V_t=1Vand W/L = 10.
   a. V_{GS}=5V and V_{DS}=6V
   b. V_{GS}=0V and V_{DS}=6V
   c. V_{GS}=2V and V_{DS}=-0.5V

4. An NMOS transistor has V_t=0.8V, k'^n= 0.05 mA/V^2, and W/L = 2. The device is biased at V^{GS}=2.5 V. Calculate the drain current and the resistance r_O for V_{DS}=2V and 10V for
   a. λ=0
   b. λ=0.02
   c. V_A=35V

5. A PMOS transistor has k'_p= 0.1 mA/V^2, W/L = 2, V_t= -2V and V_{SG}= 3V. Find the region of operation and the drain current for:
   a. V_{SD}=0.5V
   b. V_{SD}=2V
   c. V_{SD}=5V

6. Consider the following NMOS circuit where V_t=0.5V, k'_n= 0.4 $mA/V2$, and W/L = 5. If the circuit operates at the edge of saturation with a drain current of 1mA, find the resistor, R_D.
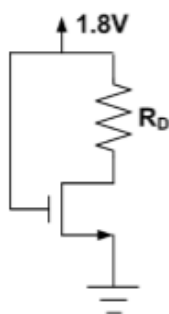
7. Consider the following PMOS circuit where V_t=-0.6V, k'_p= 250 $\mu A/V^2$, and L = 0.25μm. find the values required for W and R such that the drain current is 0.8mA and the drain voltage is 1.5V.

2.5V

V_D

R
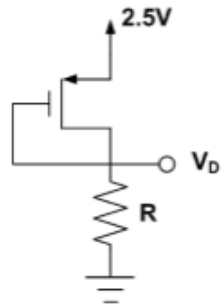
8. Find the labeled voltages and currents in the following circuit where V_{tn} =+1V, V_{tp} = -1V, k'_n= 20 $\mu A/V^2$, k'_p= 8 $\mu A/V^2$ and W/L = 3 (for both n and p-type transistors).

3V

I_D

V_O