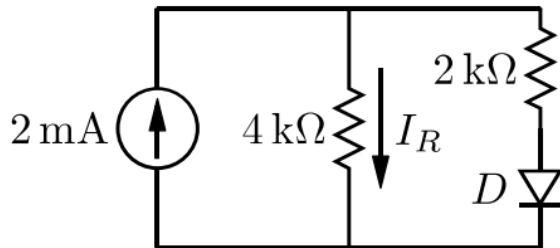




## ECE 20001 Worksheet - Week 15

### Problem 1

For the circuit in the figure below, find the current  $I_R$  using the ideal diode model.



### Problem 2

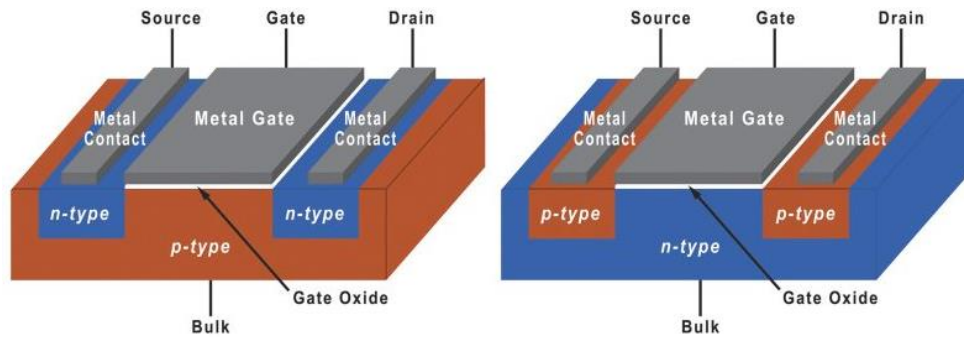
Answer the following questions about MOSFETs

- Under what condition is a NMOS turned off?
- Under what condition is a NMOS in the triode/linear region? What are its I-V characteristics?
- Under what condition is a NMOS in saturation region? What are its I-V characteristics?
- Are the off/triode/saturation conditions the same in a PMOS?



**Problem 3**

Which of the following MOSFET is an NMOS/PMOS?



**Problem 4**

An NMOS transistor with  $V_T=0.7V$  and  $k=3 \text{ mA/V}^2$  is operating at a DC current  $I_D=2.5\text{mA}$ . Without resorting to the MOSFET current equation, find the new DC current  $I_D$  if

- a) The transistor width  $W$  is halved.
  
  
- b) The transistor length  $L$  is tripled.

Explain how you arrive at your conclusion.



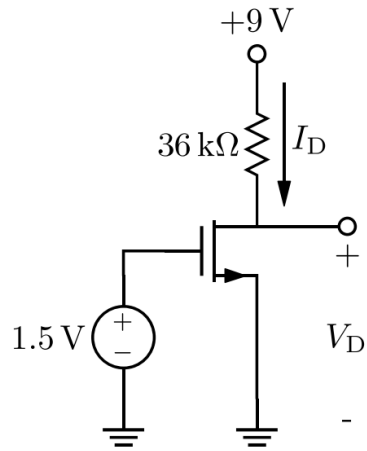
**Problem 5**

An NMOS transistor with  $V_T=0.6\text{V}$  and  $k=0.4\text{ mA/V}^2$  is operating at the edge of saturation with DC current  $I_D=0.8\text{mA}$ . Find the biasing voltage  $V_{GS}$ . If we want to lower the current at the edge of saturation to  $I_D=0.5\text{A}$ , find the new biasing voltage  $V_{GS}$ .



Problem 6

For the common source amplifier as shown with  $V_T=1V$  and  $k=2 \text{ mA/V}^2$ . Find the drain voltage and current  $V_D, I_D$





**Problem 7 (Textbook Problem 11.5-1)**

The linear amplifier shown here has  $V_T=1V$  and  $k=0.75 \text{ mA/V}^2$ . The amplitude of the input signal is  $\widehat{v_g}=0.05V$ . Find  $i_D$  and  $v_D$ .

