American University of Beirut  
Department of Electrical and Computer Engineering

EECE 310 – Electronics Fall 2011 – 2012

*Due Wednesday December 21, 2011, at 9:00 am*

**Homework 10**

**1.** Consider a CMOS inverter with the following circuit parameters:

The N-channel MOSFET has *L* = 0.18 m, *W* = 0.4 m, *V*t = 0.6 V, and *k*’ = 330 A/V2.

The P-channel MOSFET has *L* = 0.18 m, *W* = 0.8 m, *V*t = –0.7 V, and *k*’ = 170 A/V2.

The supply voltage is *V*DD = 1.8 V.

1. Find the values of *V*OL and *V*OH for this inverter.
2. Find the value of *V*OL when a 10 k resistor is connected from the output to *V*DD.   
   The input is at *V*DD. What is the total circuit power dissipation in this case?
3. Find the value of *V*OH when a 10 k resistor is connected from the output to ground. The input is at 0 V. What is the total circuit power dissipation in this case?
4. A 50 fF capacitor is connected from the output of the inverter to ground. Find the dynamic power dissipation of the inverter is the input voltage is a square wave with a cycle time of 2 ns.

*In the following two problems, assume that for a BJT in the active region,* |*V*BE| = 0.7 V.

**2.** The base current of the transistor shown in Fig. 1 is 30 A. The BJT has ** = 120.

a) Assume that the BJT is active. Find *I*E and the required value of *R*B.

b) Find *V*CE and verify that the BJT is operating in the active region.

c) If the emitter of the BJT is grounded, would the transistor remain in the active region? Use the value of *R*B calculated in part (a).

**3.** The PNP transistor shown in Fig. 2 has ** = 0.989. Find *R*E and *R*C to get *I*E = 0.15 mA   
and *V*EC = 3.3 V.

 

Figure 1 Figure 2