Name: you didn't get this from me Date to be handed in: Tuesday, March 14, 2020 before 9:00AM

INEL 4207 Take Home Test

Use the following Specs if they are not stated in the problem.

V_{DD}=6 V u_nC_{ox}=4 =229 uA/V^2 V_{TN0}=0.59 V V_{TP0}=0.77 V $(W/L)_N$=44 $(W/L)_P$=4

C_L=80 pF $\gamma=0.016\sqrt{V}$ 2ϕF=0.6V β= 28 V_{BE}=0.7V

Answer each question thoroughly. Show your equations and justify your assumptions. Write all your answers on the answer sheet and submit it with all calculations. Make sure all units are clearly stated.

1. Using figure **1** connect a Capacitor C_L on its output and determine the following:
   a. What digital function implemented?
   b. Calculate V_{OH} and V_{OL} taking into account the body effect.
   c. Calculate tr,(t rise)

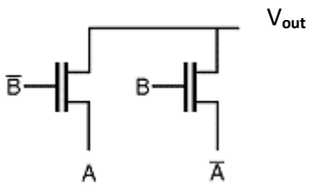


Fig. 1

2. Design a domino A+B+C with a PMOS equivalent transistor of 4 and an equivalent NMOS Transistor =44
   a. Draw the net or graph (grafo) representing the Pull Down network of your circuit
   b. Calculate the W/L of equivalent NMOS and PMOS transistor
   c. Calculate VOH and VOL of the previous circuit and tphl (propagation from high to low)

3. Read carefully and use **Figure 2** to answer
   a. Determine Vref (V_R) if V_{BE}=V_{D1}=V_{D2}=0.75 V for I=1mA and β= 28 for all BJT.

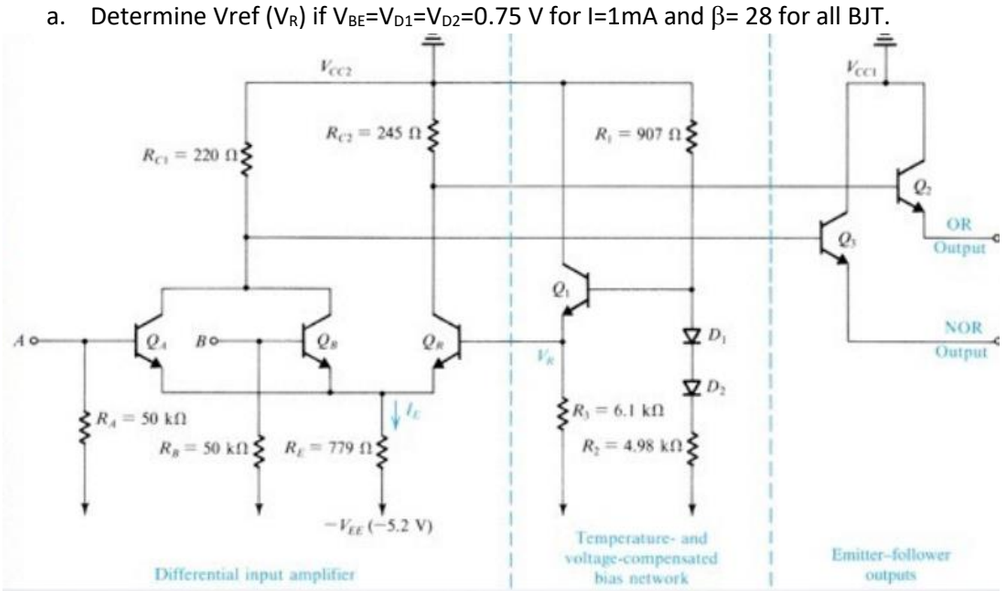
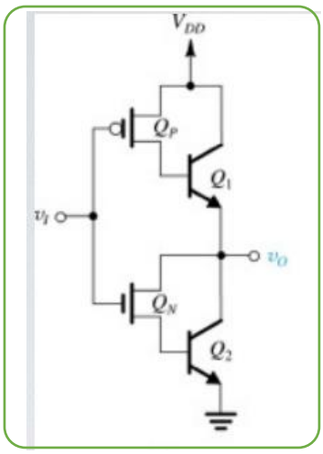
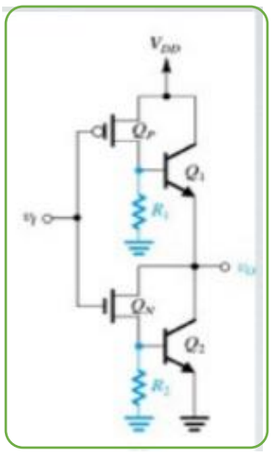


Fig. 2 ECL circuit

4. Answer using the following figure 3 (a), (b) and (c)





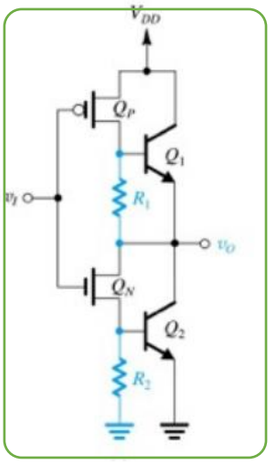


Fig. 3 (a) (b) (c)

a. Using the figure of the BiCMOS circuit (fig c) with a capacitor load of 45 calculate tphl (propagation from high to low)
b. Calculate the ouput current of fig. (fig c) when Vout=(V_{OH}+V_{OL})/2

ANSWER SHEET:

1. a. Function: _____
   b. V_{OH}= _____ V_{OL}= _____
   c. tr,(t rise)= _____

2. Schematic

   a. Graph

   b. $(W/L)_N$:_____ $(W/L)_P$: _____
   c. V_{OH}: _____ V_{OL}: _____ tphl (propagation from high to low):_____

3. a. V_R= _____

4. a. tphl (propagation from high to low)= _____

   b. Iout= _____