VLSI Design : Quiz-1

Monsoon 2025, IIIT Hyderabad (Instructor: Prof. Abhishek Srivastava)

Date : 29^{th} Aug, 2025, Duration : 1 Hour, Max. Marks : 10

Instructions:

- Clearly write your assumptions (if any)
- Use of own hand-written notes on 1 A4 sheet (both sides) is allowed
- Calculators are allowed
- Mobile phones, laptops are not allowed

1. For the circuits shown in Fig. 1(a) and Fig. 1(b), find
   (a) Maximum and minimum values of V_{out1} for $V_{in} = Vdd$ and $V_{in} = 0$V, respectively. Given $V_{ctrl1} = Vdd$. [1]
   (b) Maximum and minimum values of V_{out2} for $V_{in} = Vdd$ and $V_{in} = 0$V, respectively. Given $V_{ctrl2} = 0$V. [1]

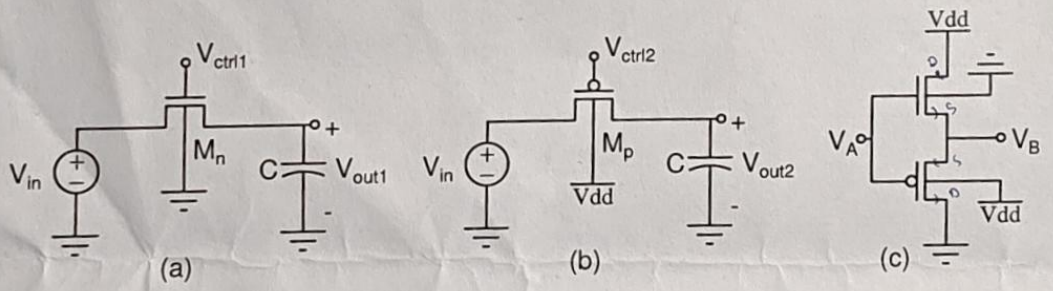

Figure 1

2. (a) Can the circuit shown in Fig. 1(c) be used as a non-inverting CMOS buffer? Discuss. [1]
   (b) Derive the input voltage expression for which both the transistors in a CMOS inverter are in saturation. What is the output voltage range for this scenario. [2]

3. Define noise margin parameters for a CMOS inverter. Clearly show the points on the VTC of the inverter and mention the region of operation of the MOSFETs. Discuss why those points are considered for defining noise margin of the inverter. [2]

4. Derive the expressions for V_{IH} and V_{OL}. It is given that $\mu_n C_{ox} \frac{W}{L}_n = \mu_p C_{ox} \frac{W}{L}_p$ and $|V_{TN}| = |V_{TP}|$. Clearly show all steps. [3]

Good luck !!