Assignment 1

Problem 1:
Design a CMOS inverter in 180nm technology.

1. Plot the transfer characteristics.
2. Plot the leakage currents (for both HIGH and LOW input conditions) through the inverter.
3. Change the body bias of the transistors (**Case 1**: keep V_{bp}=Vdd and vary V_{bn} , **Case 2**: keep V_{bn}=Vss and vary V_{bp})and notice the effect of body biasing on leakage current. Explain the change in V_T with the change of body bias. Plot leakage current versus V_{bn} for Case 1 and leakage current versus V_{bp} for Case 2.

- **Explanation is mandatory.**
- Take Wp/Wn = 2.4, L=180nm, V_{dd}=1.8V, V_{ss}=0. V_{bp} is the substrate potential of pMOS and V_{bn} is the substrate potential of

Problem 2:
Design a CMOS 4 input NAND gate with W/L=1. Consider the following three cases:
Case 1: All pMOS substrates bias are V_{dd}. All nMOS substrates are connected to their source.
Case 2: All pMOS substrates bias are V_{dd}. All nMOS substrates are connected to V_{ss}.
Case 3: All pMOS substrates are connected to 1.2V, and all nMOS substrates are connected to 0.5V.
For each of the above three cases plot the leakage current for the following input patterns:

0000
0001
0011
0111
1111

Take other parameters as in Problem 1. **Explanation is mandatory.**

Problem 3:
Design a CMOS inverter with the above technology (Wp/Wn=5.0) and plot VTC. Find NM_L and NM_H.

Submission Deadline: on or before 25th January, 11:59 PM. No submission will be entertained after the specified deadline.

If you have an id at AVLSI Lab you may use that or you can use the following id in AVLSI lab.
Login Id: apal
Password: 123apal

Please create subdirectory for each group and do your work under that directory. Do not use other's directory. Plagiarism is strictly prohibited. If two reports get matched then both the groups will get zero (or negative) marks. You can make groups (at most 2 persons) of your choice. If you fail to create a group you may do the assignments alone or I'll make the groups. Send the soft copy of your report to subho.mukerji@gmail.com. Report should contain names and roll numbers of the group members. The subject of your submission mail must be "**LPC <Roll Numbers>**" (no special character). Hard copy submission is must. You may also require to give demonstrations before mid and end semester exams.

After you create your group, mail me the list of group members along with your roll numbers. My email id is subho.mukerji@gmail.com. The subject should be "**LPC Group**". Please do not write a

different subject otherwise your request will not be considered. I'll upload the group list as soon as I get the names.

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