

COE360 – Assignment # 4
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For this assignment, use WinSpice and the specified technology. You can get WinSpice from my shared folder \\coe-elrabaa\sharedFolder\IC Design Resources\WinSpice or from the internet. There are 2 example Spice files on my website; one for DC analysis and another for transient analysis (do not forget to use the appropriate technology though!).

Q1) Use SPICE to find the following parameters of the 0.5 μm technology:

V_{tn} , V_{tp} , $I_{DSat(NMOS)}$ and $I_{SDsat(PMOS)}$

Hint: Use a single NMOS and a single PMOS circuits. Do a DC sweep on VGS (for NMOS) and VSG (for PMOS) with the drain connected to the gate to find V_{th} (when the device starts to turn on) and I_{DSat} (I_{DS} when $V_{GS}=V_{DS}=V_{DD}$)

Q2) Design an NMOS inverter (using the parameters obtained in Q1 above) with the following specs: $P_{DCAve} = 100 \mu\text{W}$, $V_{DD} = 5\text{V}$, $V_{OH} = 5\text{V}$ and 2.5V logical threshold. Calculate V_{OL} .

Q3) Use SPICE to find the actual values of P_{DCAve} , logical threshold, V_{OL} and the average propagation delay with a 0.2pF load capacitance of the NMOS inverter you designed in Q2.

Hint: Use operating point analysis (i.e. .op) to measure P_{DCAve} , logical threshold and V_{OL} and use transient analysis (i.e. .tran) to measure the average delay.