Design Assignment -2

This assignment has the maximum weightage among all the assignments

Design a 2-stage OTA in TSMC180nm technology.

TSMC 0.18µm technology parameters (taken from model file):
V_{Tn} = 0.37V; V_{Tp} = 0.39V; $\mu_n C_{ox}$ = 230 µA/V^2; $\mu_p C_{ox}$ = 100 µA/V^2; V_{dd} = 1.8V; L_{min} = 0.18µm; W_{min} = 0.27µm;

The designed opamp, should be used to make a non-inverting amplifier of gain 2 The DC gain of the opamp should be at least 40dB.

- The first part of your report should be your hand-design, and you should tabulate all calculated values as required in section
- Tabulate the following from your simulated design:
  (a) W, L and operating points (g_m, r_o, V_{GS} -V_T, I_D) of all transistors. Use transistor names as follows: M_0 = input stage current source; $M_{1\text{-}2}$ =input differential pair; $M_{3\text{-}4}$ = current mirror active load; M_5 = second stage amplifier; M_6 =second stage current source.
  (b)Values of other components in the opamp.
  (c) DC gain of the opamp
  (d) Power consumption
- Plot the transient response of the closed-loop amplifier with a 0.2V input step (use 0.1ns rise/fall times).

- Do not use an ideal current source in the tail. You can use one ideal reference current source of 1/10th the tail current of the input differential pair for bias generation

- You can assume a gate overdrive of 200mV in your initial calculations.

- Run a DC operating point simulation to get the small signal parameters from simulation. Adjust the bias currents/MOSFET sizes to get closer to the required parameters.

- You can also use the small signal parameters obtained from simulation to fine-tune the hand-calculated values, and get better estimates of other component values.