**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):

*VTn* = 0.37V; *VTp* = 0.39V; *μnCox* = 230 μA/V2; *μpCox* = 100 μA/V2; *Vdd* = 1.8V; *Lmin* = 0.18μm; *Wmin* = 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 (gm, ro, VGS -VT, ID) of all transistors. Use transistor names as follows: M0 = input stage current source; M1-2 =input differential pair; M3-4 = current mirror active load; M5 = second stage amplifier; M6 =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.