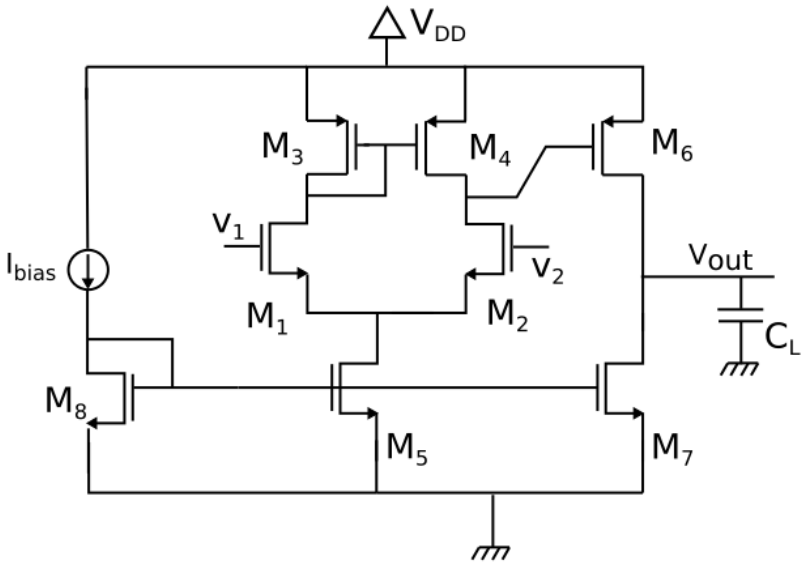
Unit 6: EXERCISES

Ex1. Design a comparator that accomplishes with the next requirements:

V_{DD}	3 V
P (max)	2 mW
A_V	2200 V/V
V_{oH}	2.7 V
V_{oL}	0.3 V
SR	10 V/us
C_L	3 pF
T delay	1 us
v_p-v_n min	10 mV
ICMR	Between 1.5 and 2.5 V

Data: $\mu_n C_{ox}$ = 120 µA/V², $\mu_p C_{ox}$ = 40 µA/V², $\lambda_p = \lambda_n$=0.04 V^{-1}, $|V_{thp}| = |V_{thn}|$=0.7 V, λ_n=0.04 V^{-1}, L_{min} = 1 µm

We may try with a Miller configuration:



1) Estimation of I_D due to power consumption:

$$I_{D,max} = \frac{P_{max}}{V_{DD}} \rightarrow I_{D,max} = 667\ \mu A$$

2) Propagation delay:

Dominant pole, propagation delay: $t_{prop} = 0.69 R_{OUT} C_L$

Slew rate, propagation delay: $t_{prop} = \frac{V_{OH} - V_{OL}}{2SR} \rightarrow SR = 1.2\ {}^{V}/_{\mu s}$

$$SR = \frac{I_{D6}}{C_L} \rightarrow I_{D6} = 10\ \mu A$$

Following the same methodology as with opamps/OTAs, the sizes are defined but with the extra requirement of the propagation delay:

Device	W/L, before simulation	W/L, after simulation
1	1	50
2	1	50
3	1	6
4	1	6
5	3	4
6	5	45
7	2	12
8	2	2