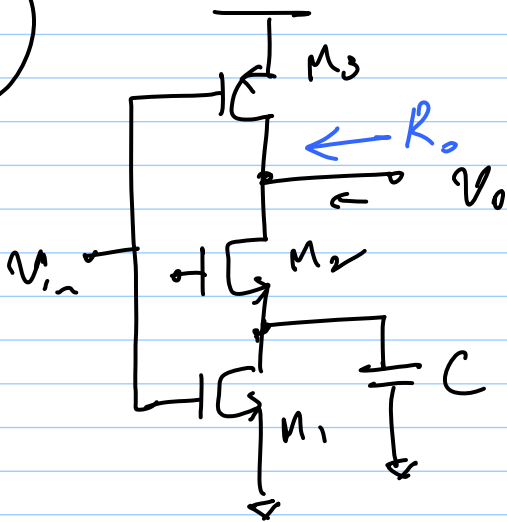


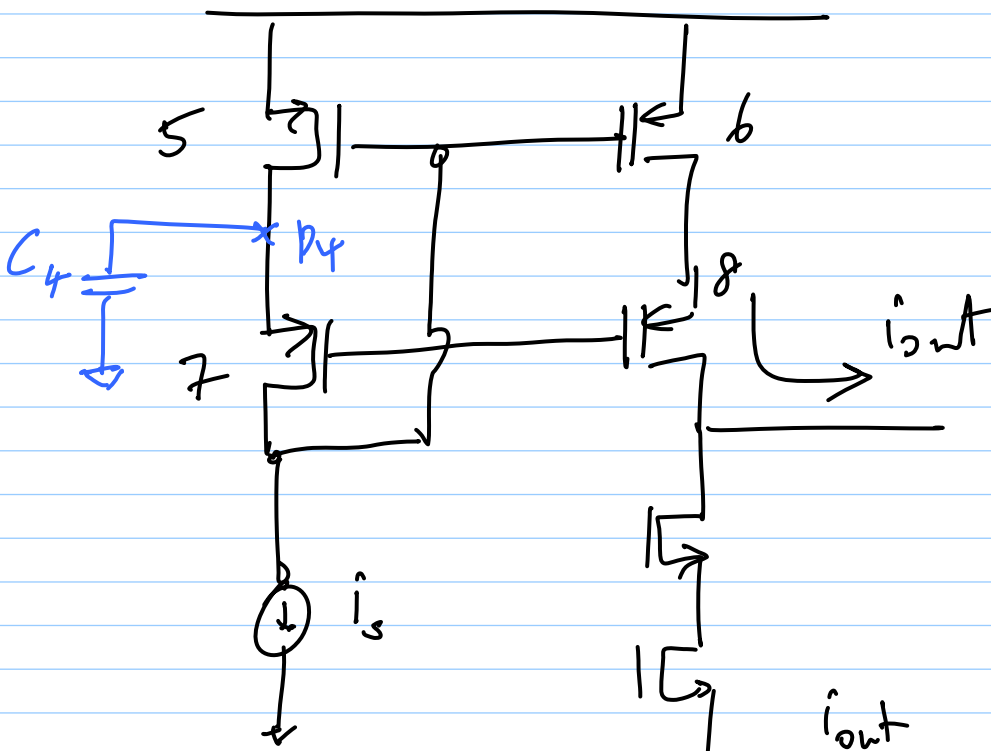
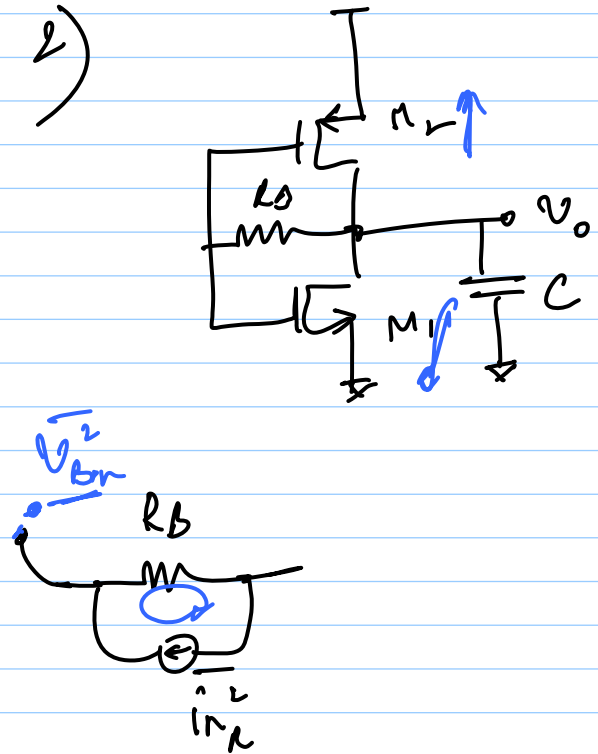
27-2-13

# Lec 27

1)



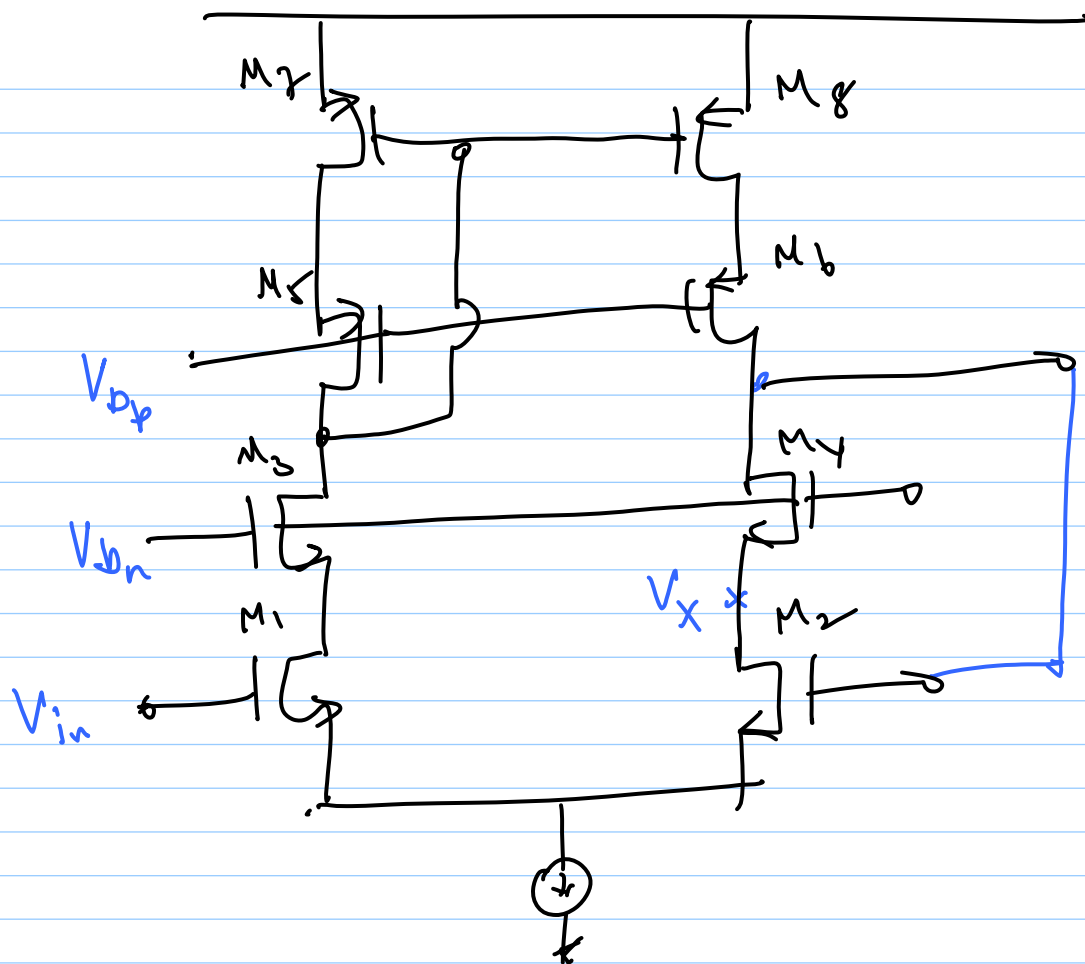
2)



$$\frac{i_{out}}{i_s} =$$

$$\frac{i_{out}}{i_s} = (1) \frac{( )}{( )}$$

$$\frac{i_{out}}{i_s} = \frac{1 + s C_4 / g_{m7}}{1 + s C_4 \cdot g_{o7} / g_{m5} g_{m7}}$$



$$V_x = V_{bn} - V_{ds4}$$

$$V_{bn} - V_{T4} \leq V_{out} \leq V_x + V_{T2}$$

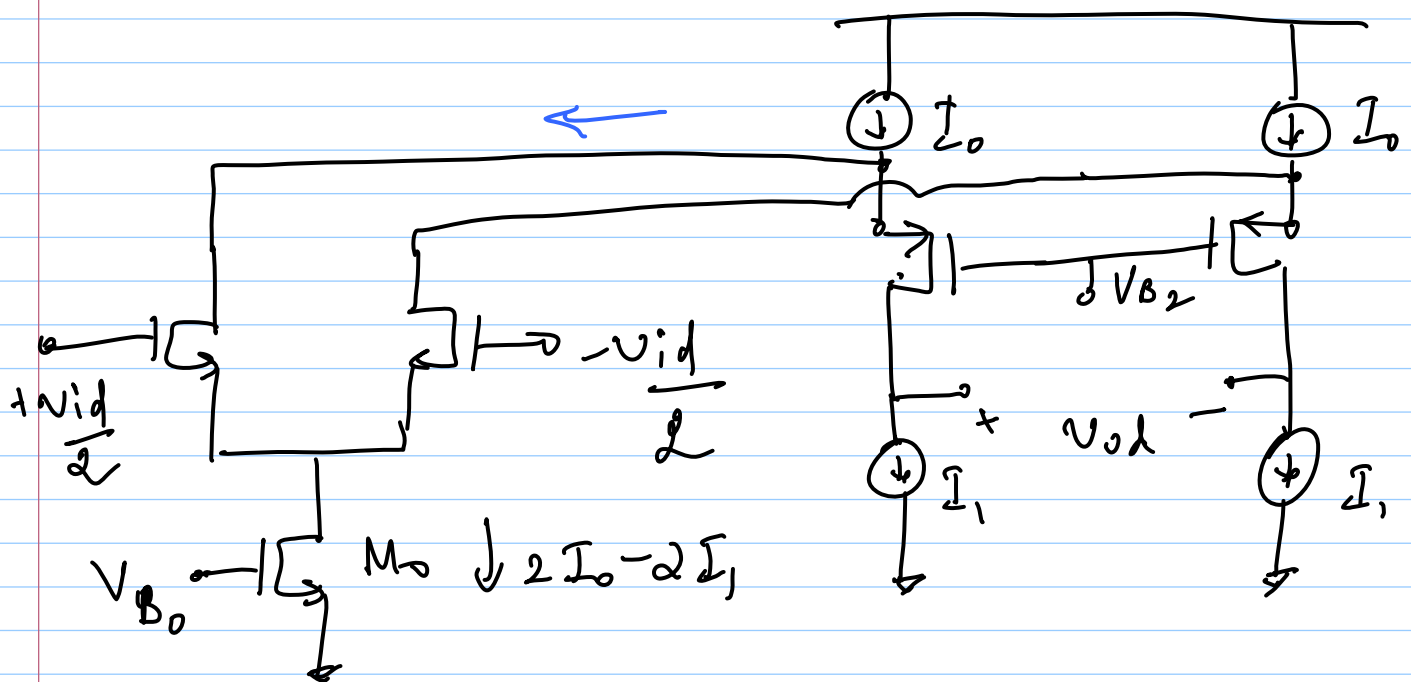
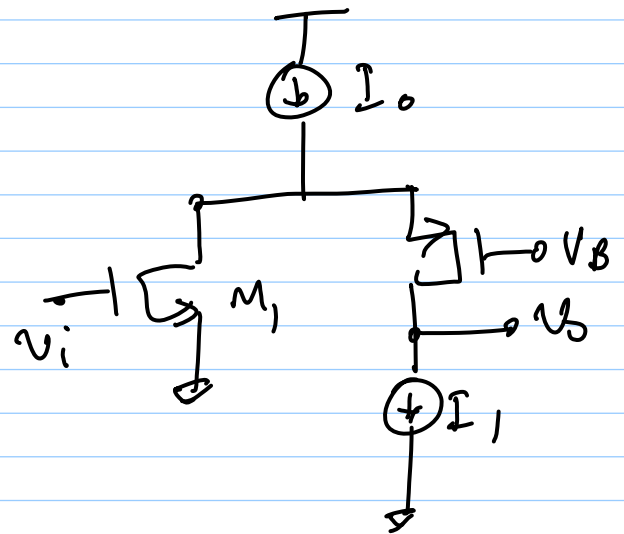
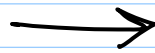
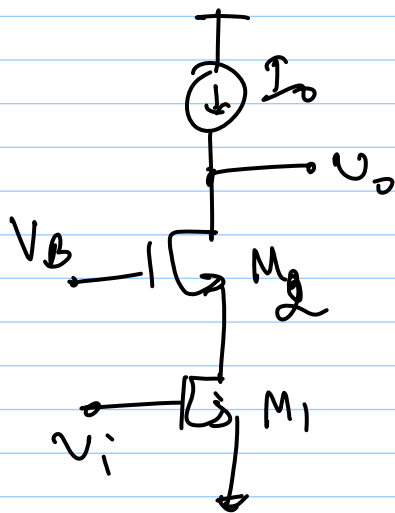
$$V_{bn} - V_{ds4} + V_{T2}$$

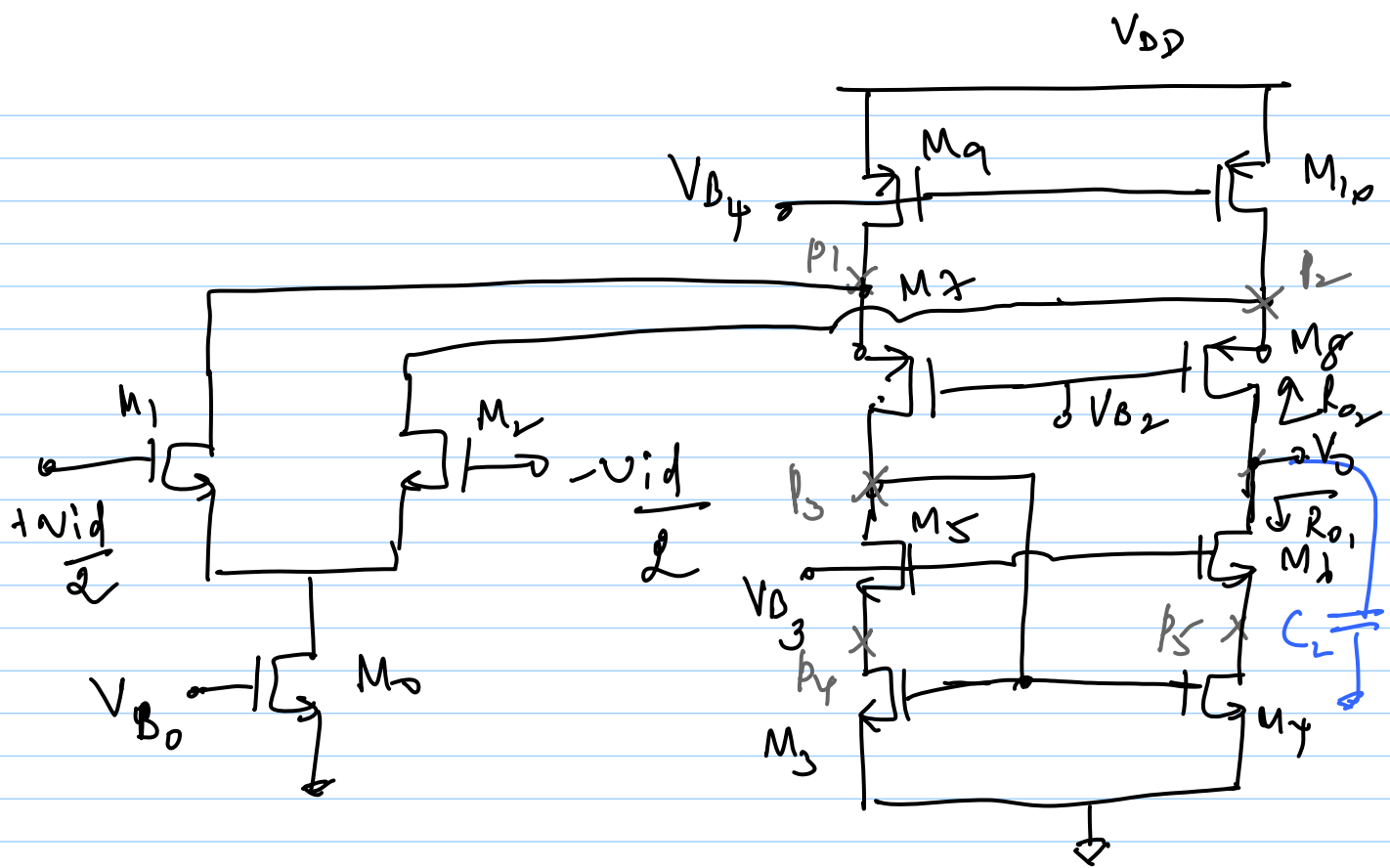
$$\Delta V_{out} (\text{max} - \text{min}) = V_{T2} + V_{T4} - V_{ds4}$$

$$= V_{T2} - V_{ds4}$$

very small

# Folded Cascode Opamp





1) DC gain =  $G_m \cdot R_o$

$$g_{m1} \times (R_{o1} \parallel R_{o2})$$

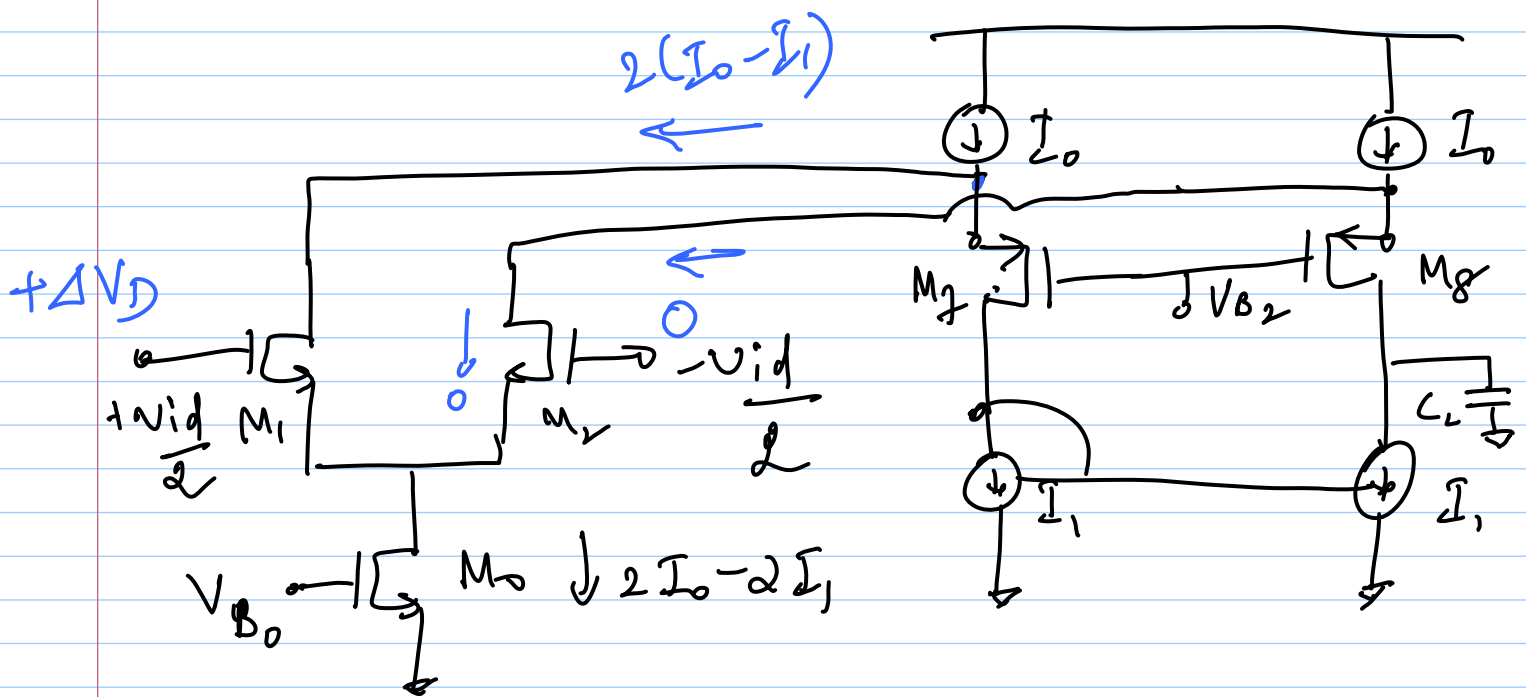
$$(g_{m6} r_{o6}) \cdot r_{o4} \quad (g_{m8} r_{o8}) \cdot (r_{o10} \parallel r_{o2})$$

slightly smaller than telescopic

2)  $\omega_n = \frac{g_{m1}}{C_L}$

3) w/o poles & zeroes

4) SR :



$$\begin{aligned} I_7 &= I_0 - 2I_0 + 2I_1 \\ &= 2I_1 - I_0 \end{aligned}$$