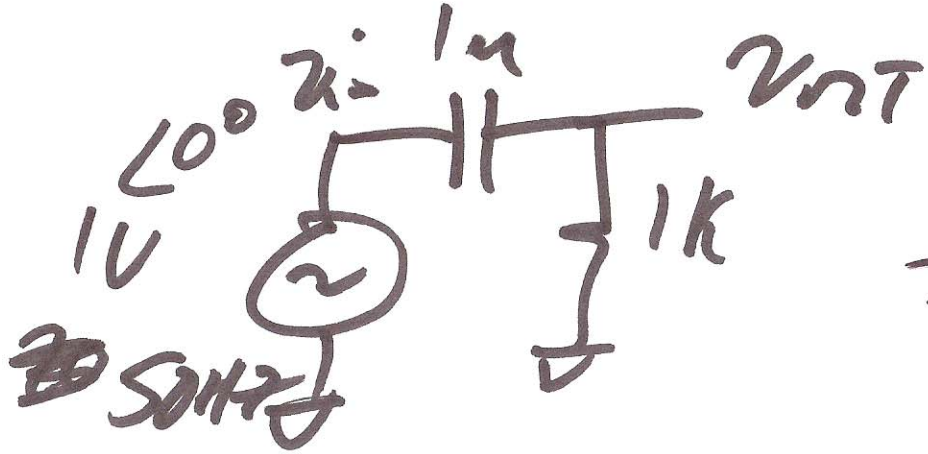
EE 420 / ECG 620

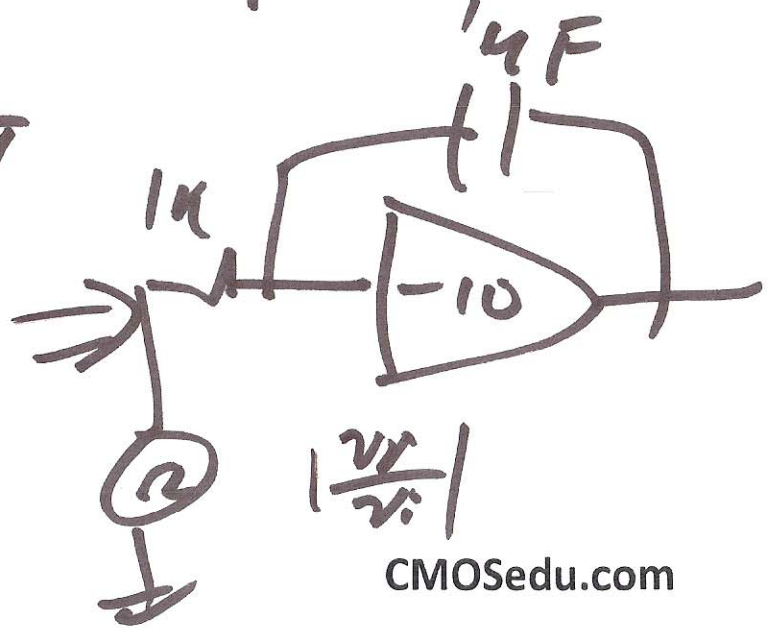
ANALOG IC DESIGN

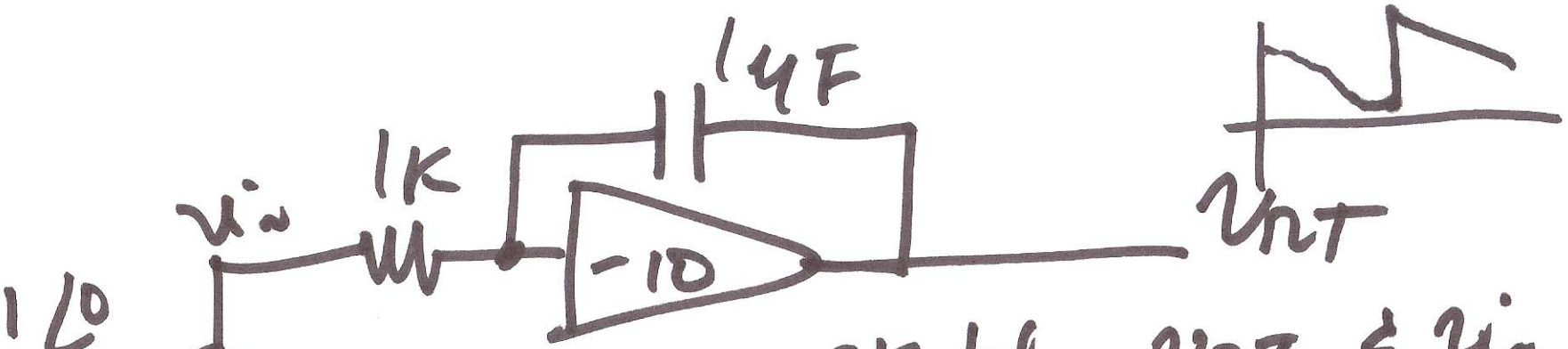
MARCH 23, 2015

Lecture 19

study H.W. & Quizzes



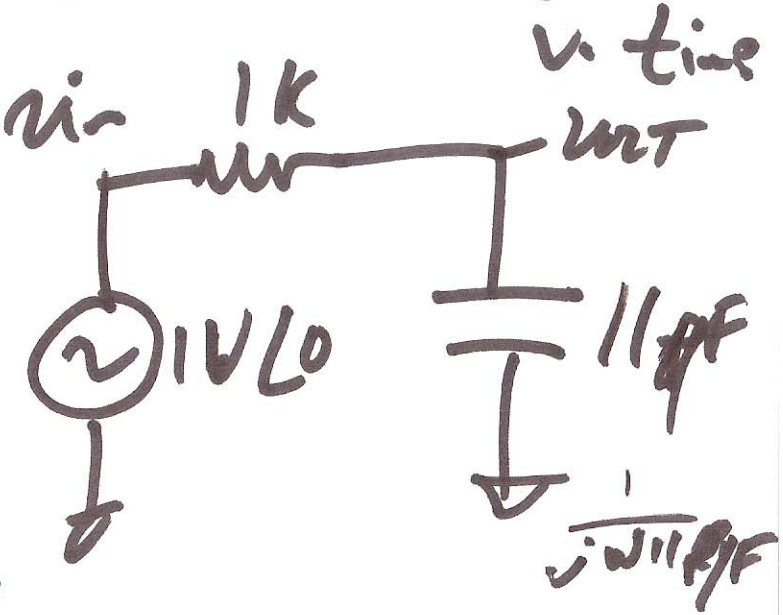




Sketch v_{out} & v_{in} on the same plot vs time

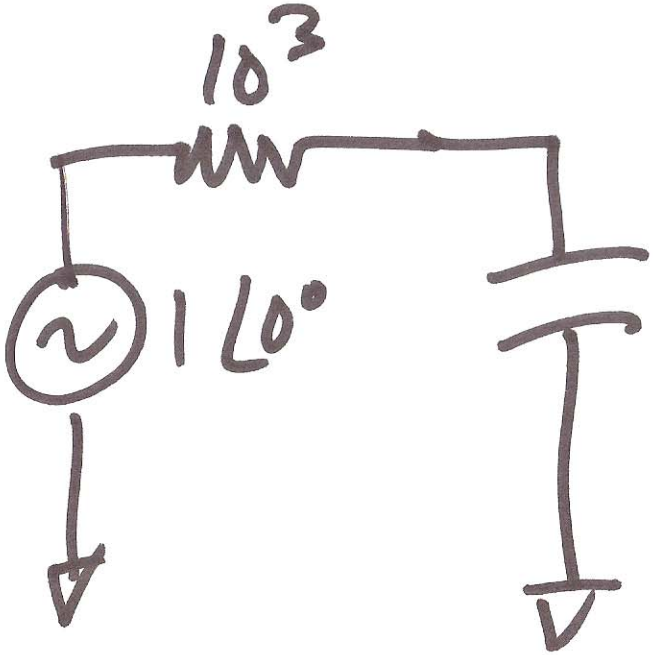
$$\left|\frac{v_{out}}{v_{in}}\right|_{f=0} = 10$$

$$\angle\left|\frac{v_{out}}{v_{in}}\right|_{f=0} = \pm 180$$



$$V_{out} = V_{in} \cdot \frac{\frac{1}{j\omega 11pF}}{\frac{1}{j\omega 11pF} + 1K}$$

$$\frac{V_{out}}{V_{in}} = \frac{1}{1 + j \cdot 2\pi \cdot 10^3 \cdot 10^3 \cdot 11 \cdot 10^{-6}}$$



$$\frac{1}{j 2\pi \cdot 10^3 \cdot 11 \cdot 10^{-6}} = \frac{1}{j 2\pi \cdot 11 \cdot 10^{-3}}$$

$$= -j \cdot 14.5$$

$$\frac{V_{out}}{V_{in}} = \frac{-j14.5}{-j14.5 + 10^3}$$

$$= \frac{1}{1 + j \cdot \frac{10^3}{14.5}} \rightarrow 69$$

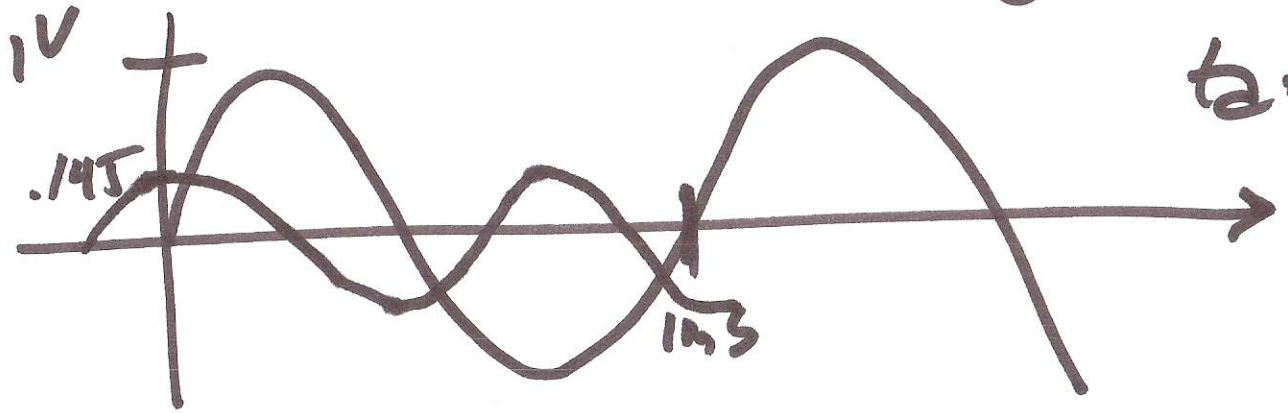
$$\frac{V_{OUT}}{V_{in}} = \frac{-10 + j0}{1 + j \cdot 69}$$

$$\left|\frac{V_{OUT}}{V_{in}}\right| = \frac{10}{\sqrt{1^2 + (69^2)}} \simeq \frac{10}{69} \simeq .145$$

$$\angle \frac{V_{OUT}}{V_{in}} = 180 - \tan^{-1}\frac{69}{1} \simeq 90^\circ = -270^\circ$$

$\theta = 90^\circ = \frac{t_2}{1\text{ms}}$ .3K

$t_2 = 250\mu s$



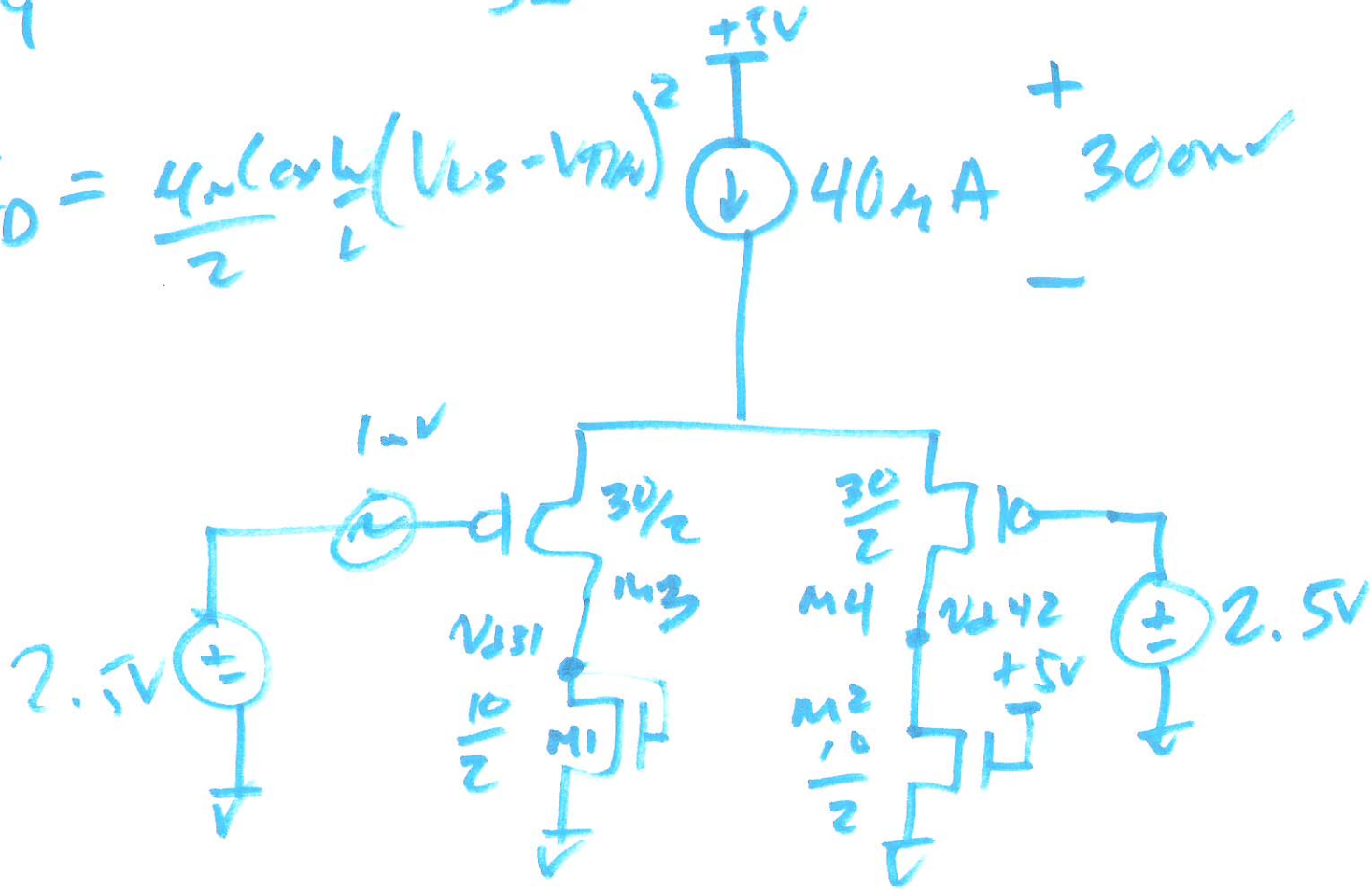
Ex. 9.5 (PMOS Flavor)

freq. response

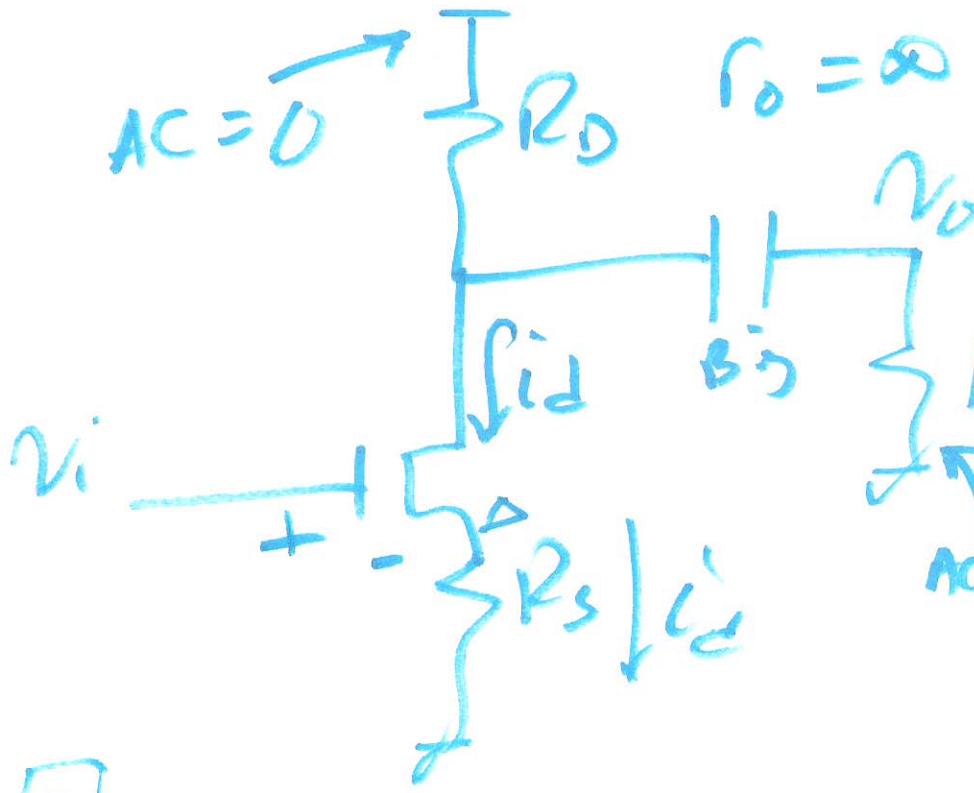
slew rate

Ch. 9

$$I_D = \frac{\mu_n C_{ox}}{2}\frac{W}{L}(V_{GS} - V_{TN})^2$$



Calculate the gain, $\frac{v_o}{v_i}$



$$\frac{v_o}{v_i} = -\frac{R_D \| R_L}{1/g_m + R_S}$$

$$v_i = v_{gs} + i_d \cdot R_S$$

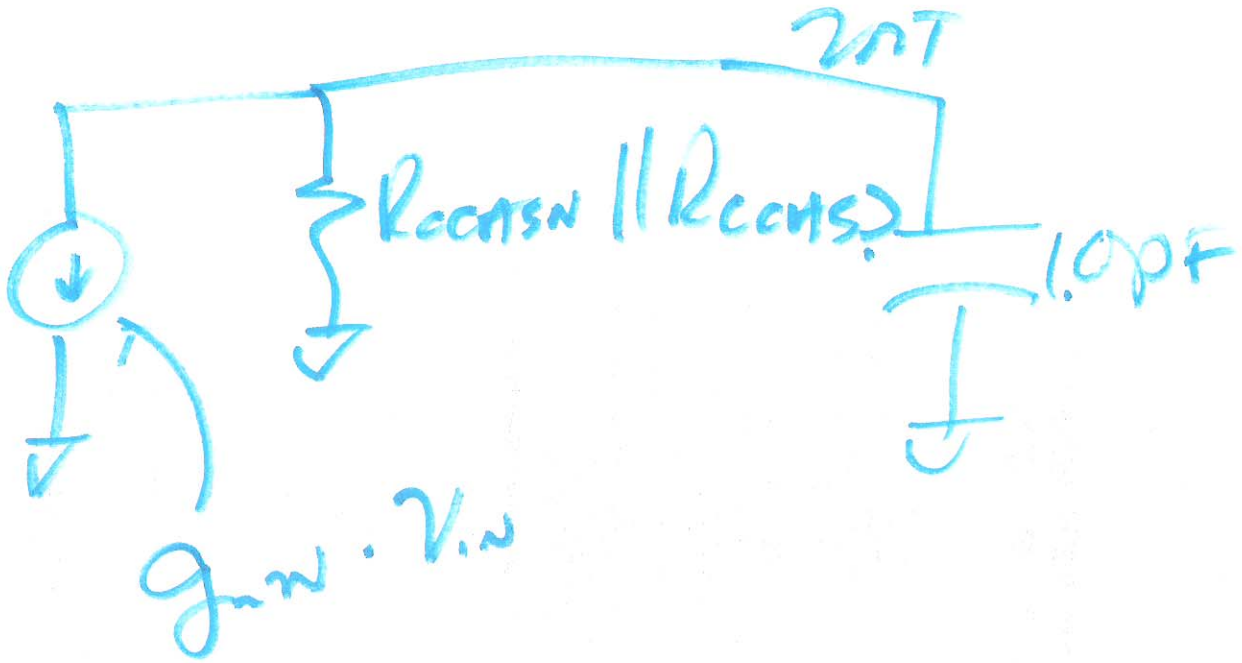
$$v_i = i_d \cdot \left(\frac{1}{g_m} + R_S\right)$$

$R_D \| R_L$

i_d

$$v_o = -i_d \cdot R_D \| R_L$$

$$\frac{v_o}{v_i} = \frac{-i_d \cdot R_D \| R_L}{i_d \left(\frac{1}{g_m} + R_S\right)}$$



$$-g_{mN} \cdot R_{ON5N} \| R_{ON5P}$$

$$= \frac{-R_{ON5N} \| R_{ON5P}}{1/g_{mN}}$$