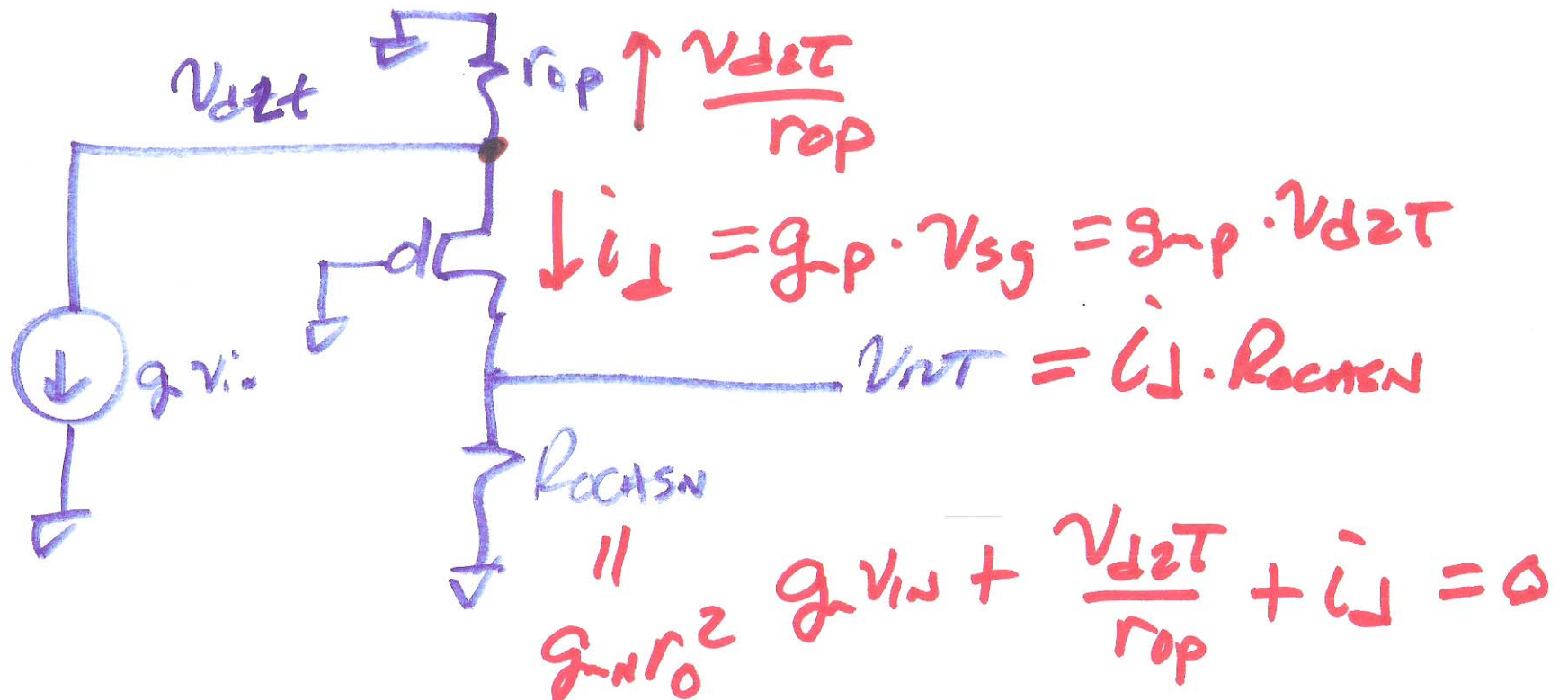


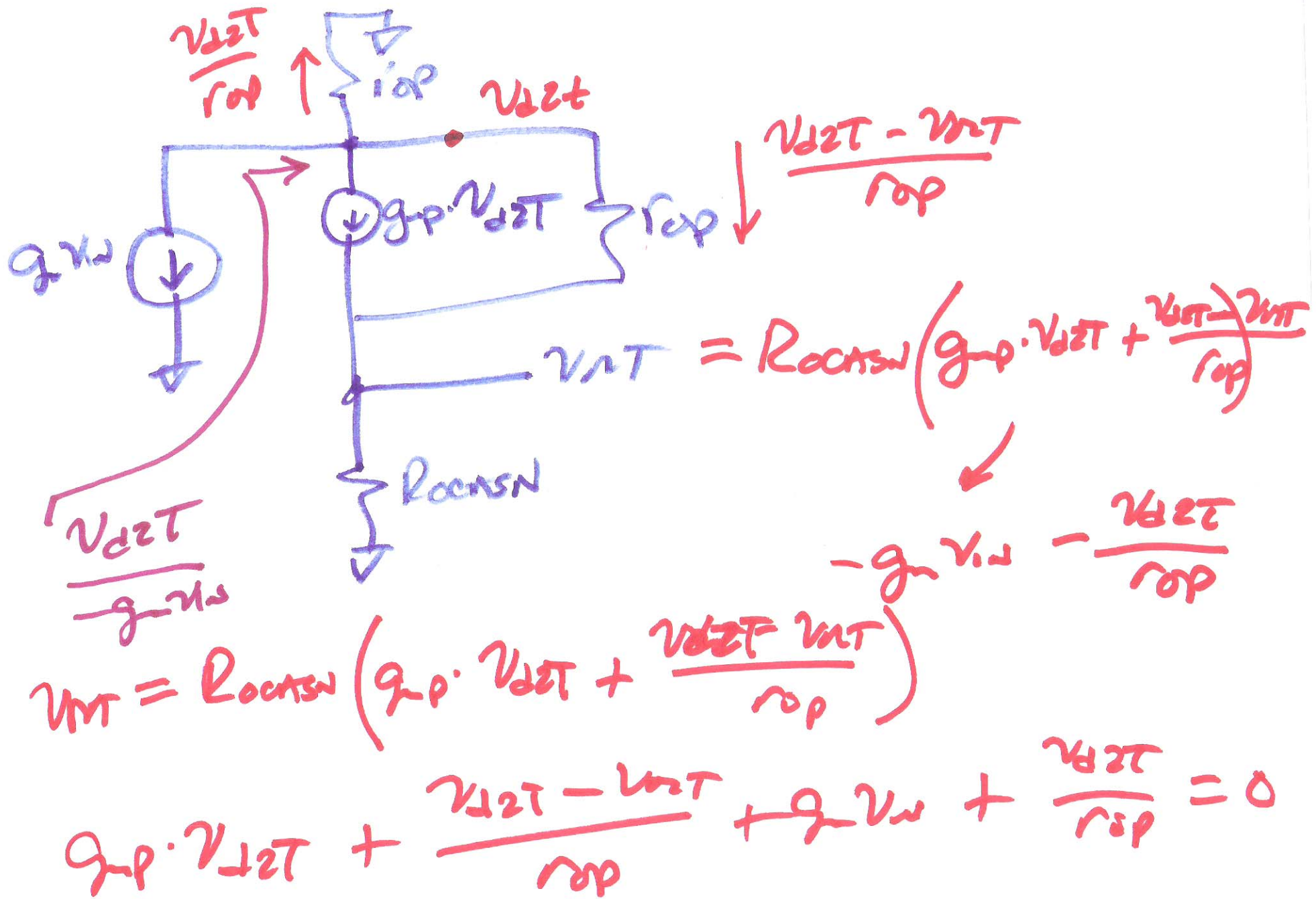
EE 420/ECG 620

Lecture 16

MARCH 11, 2015

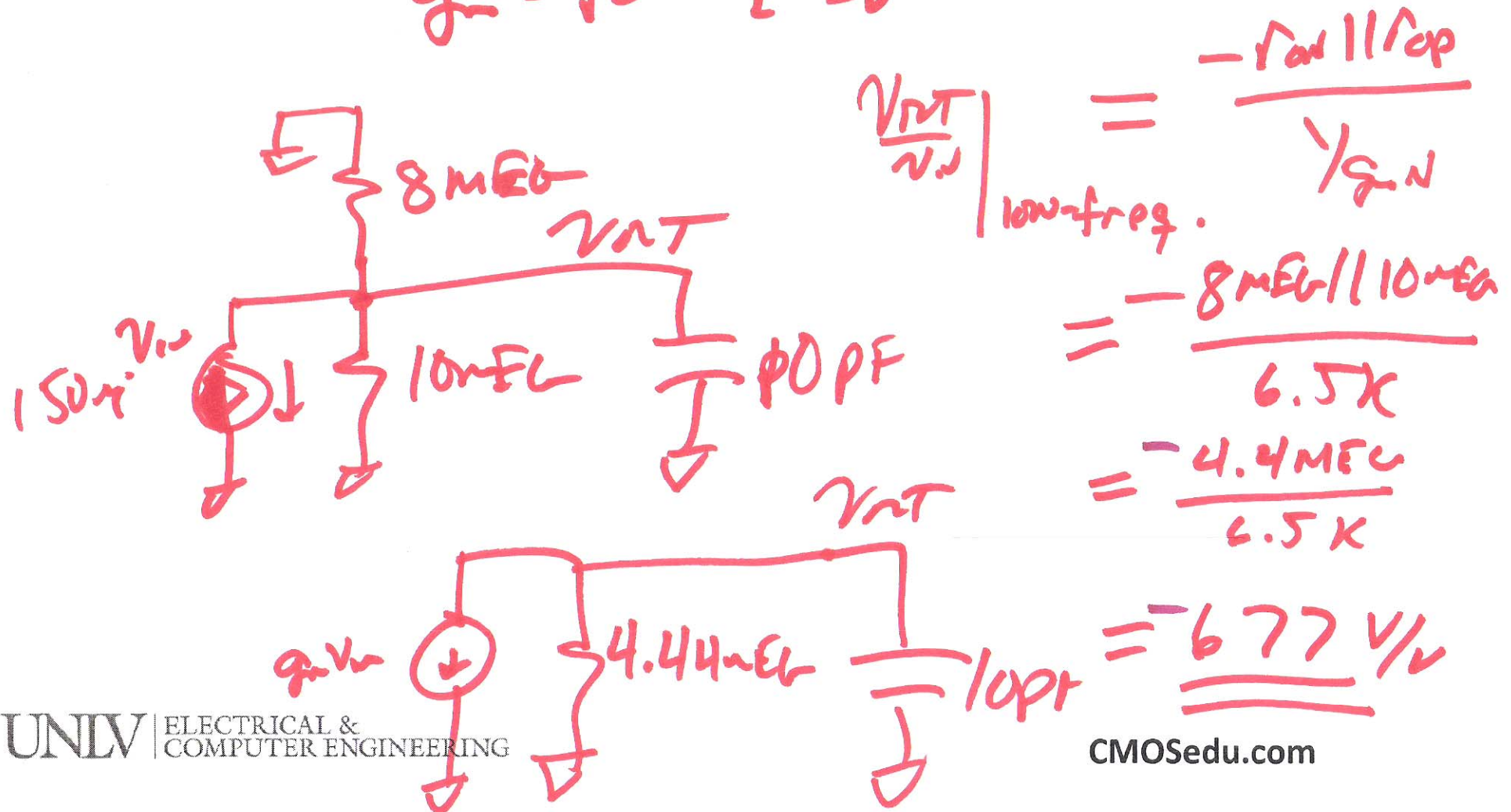


$$R_{ocns} = r_o(1 + g_m r_o) + r_o$$

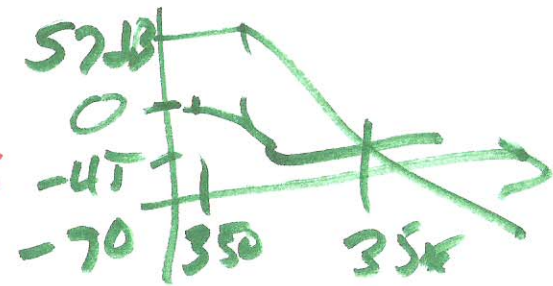
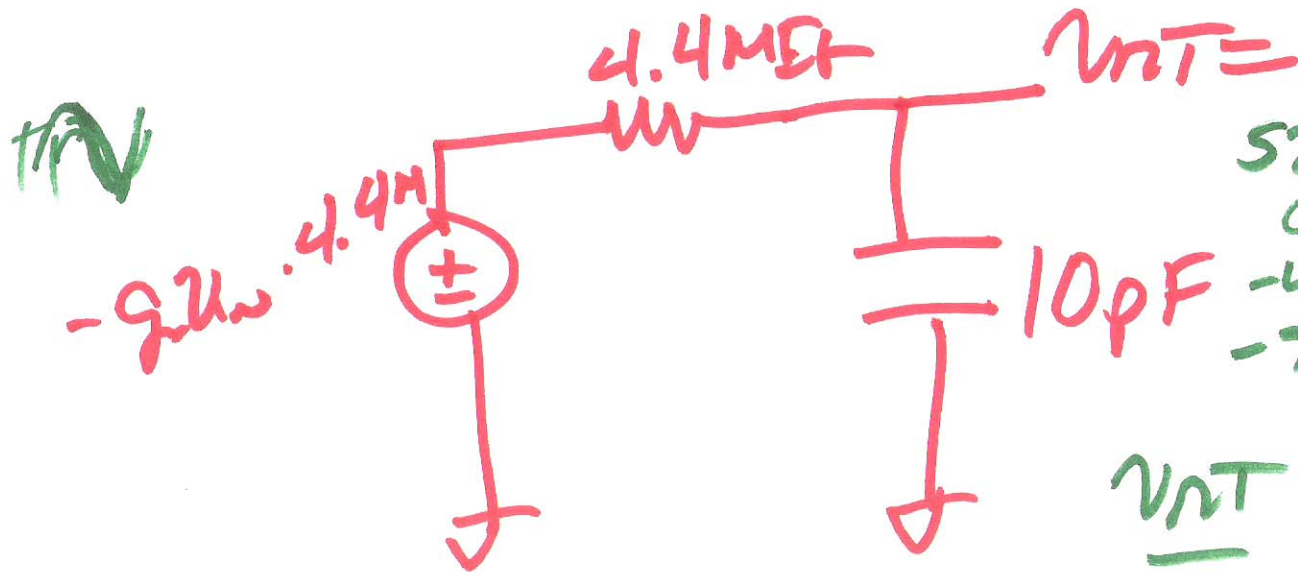


21.19) $I_D = 10 \mu A$ $r_{on} = \frac{1}{\lambda_n I_D}$, $r_{op} = \frac{1}{\lambda_p I_D}$
 $L = 2$ $r_{on} = 10 M\Omega$ $r_{op} = 8 M\Omega$

$$g_m = \sqrt{2 \cdot K_P \cdot \frac{W}{L} \cdot I_D} = 150 \mu A$$



3)



At low frequencies
CAP is open

$$\frac{v_{out}}{v_{in}} = \frac{-g_m 4.4M\Omega}{1 + j 2\pi f \cdot 4.4M\Omega \cdot 10pF}$$

$$v_{out} = -g_m v_{in} \cdot 4.4M\Omega = \frac{-g_m 4.4M\Omega}{1 + j \frac{f}{f_{3dB}}}$$

$$\frac{v_{out}}{v_{in}} = -g_m 4.4M\Omega$$

$$3.5kHz = f_{3dB} = \frac{1}{2\pi \cdot 4.4M\Omega \cdot 10pF}$$

4)

$$\frac{v_{out}}{v_{in}} = \frac{-g_m \cdot r_{out} || r_{op}}{1 + j f \cdot 2\pi \cdot C_L \cdot r_{out} || r_{op}}$$

$$f \gg \frac{1}{2\pi C_L \cdot r_{out} || r_{op}}$$

$$\frac{v_{out}}{v_{in}} = \frac{-g_m \cdot r_{out} || r_{op}}{j \cdot f \cdot 2\pi C_L \cdot r_{out} || r_{op}}$$

$$f_{in} = \frac{1504}{2\pi \cdot 10pF}$$

$$= 2.4 MHz$$

$$\left| \frac{v_{out}}{v_{in}} \right| \approx \frac{g_m}{f \cdot 2\pi C_L} \quad \boxed{f_{in} = \frac{g_m}{2\pi C_L}}$$

$$1 \approx \frac{g_m}{f_{in} \cdot 2\pi C_L}$$

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$$\frac{I}{C} = \frac{dv}{dt} = \frac{10V}{10pF} = \frac{1V}{1s}$$

~~1V/1s~~