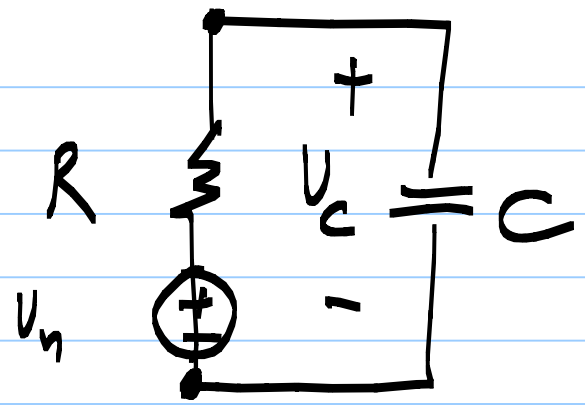
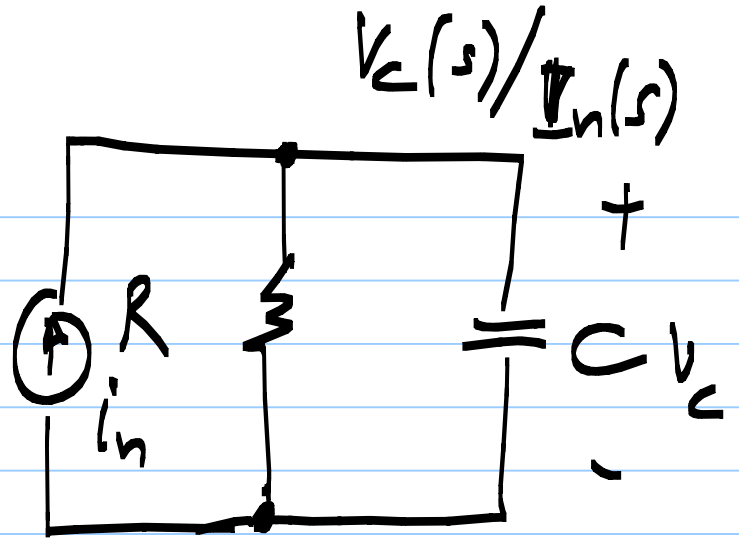




Spectral density of V_c

Variance of V_c

$$S_{V_c} = S_{V_n} \cdot \left| H(j2\pi f) \right|^2$$

$$\frac{V_c(s)}{V_n(s)} = H(s)$$

$$\int_0^\infty S_{V_c} \cdot df = \text{Variance}$$

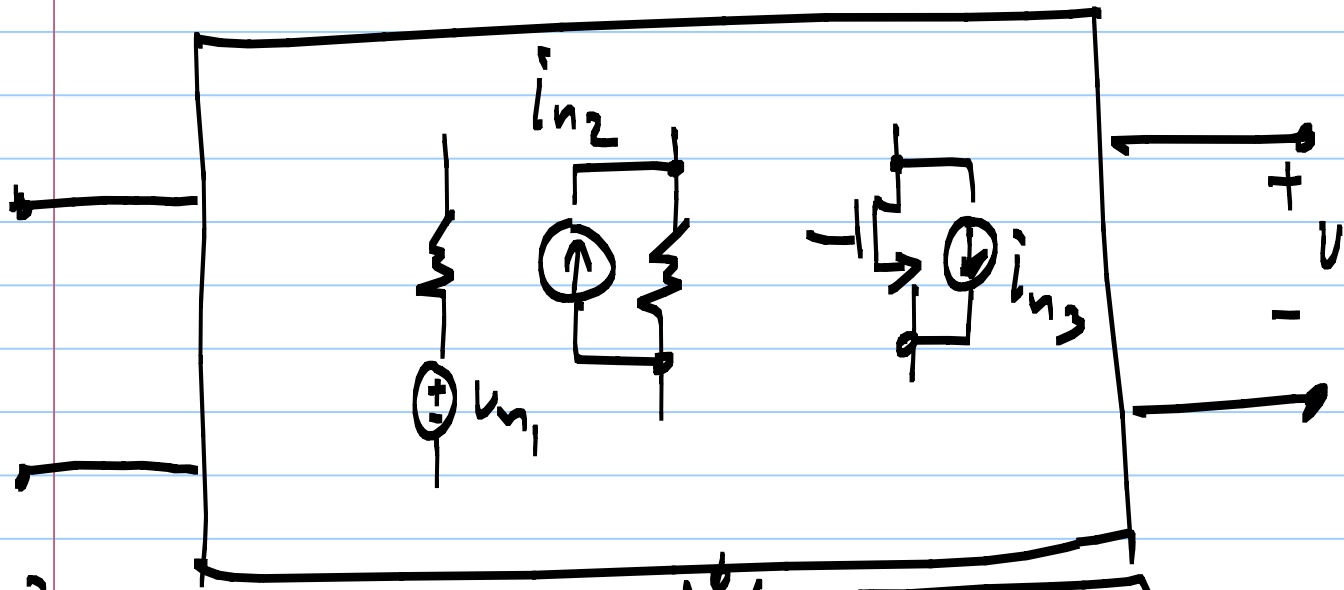
EE 6322

Vrms noise

(V)

19/1/2018

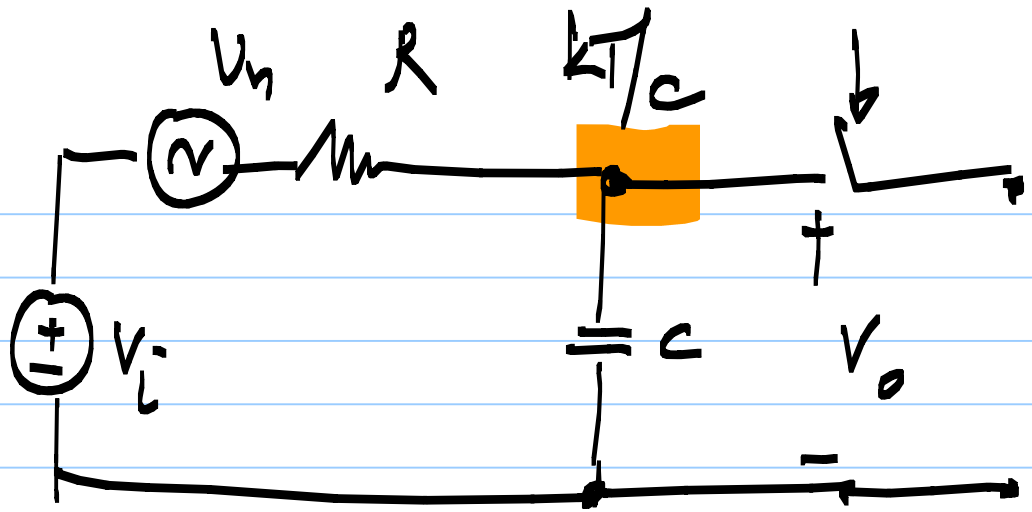
$\sqrt{\quad}$ mean squared value



$$\int_0^\infty \cdot \, df$$

V^2/Hz A^2/Hz

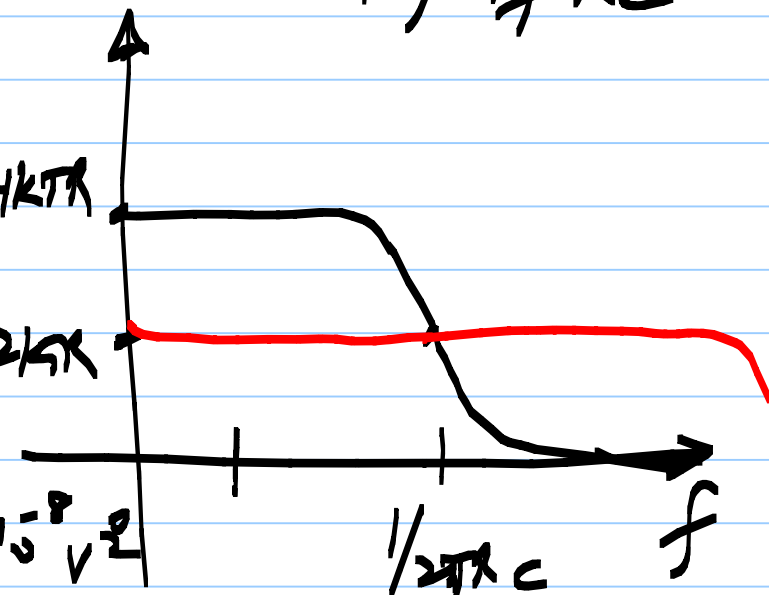
$$S_{v_{n_1}} \left| \frac{V_o}{V_{n_1}} \right|^2 + S_{i_{n_2}} \left| \frac{V_o}{I_{n_2}} \right|^2 + S_{i_{n_3}} \left| \frac{V_o}{I_{n_3}} \right|^2 = S_{v_o}(f)$$



$$\frac{V_o}{V_n} = \frac{1}{1+sRC}$$

$$= \frac{1}{1+j2\pi f RC}$$

$$S_{V_o} = 4kTR \cdot \frac{1}{1+4\pi^2 f^2 R^2 C^2}$$



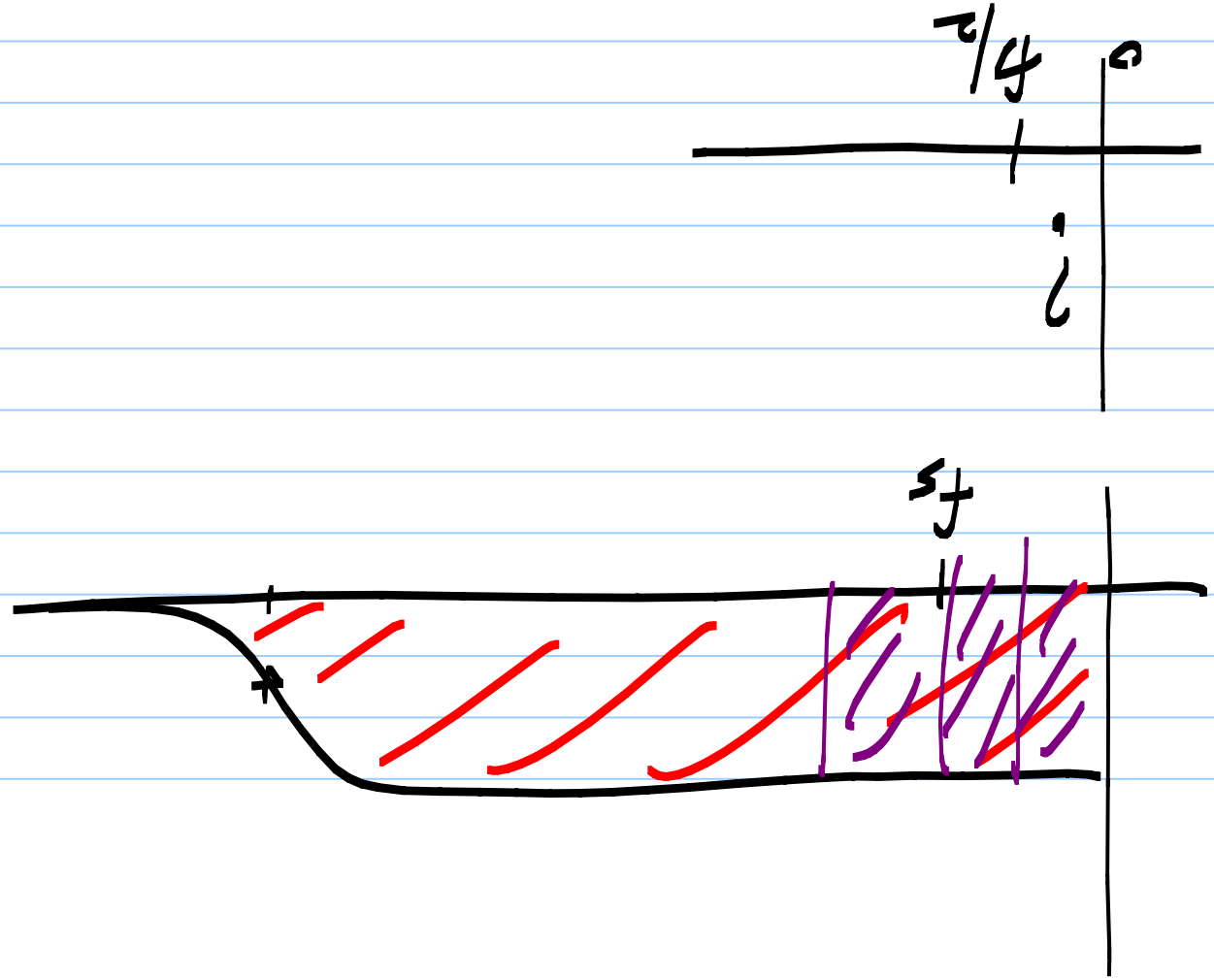
$0.1pF$: $\frac{kT}{C} \cdot \frac{4 \cdot 15^2 f}{15 \cdot 13} = 4 \cdot 15^{-8} V^2$

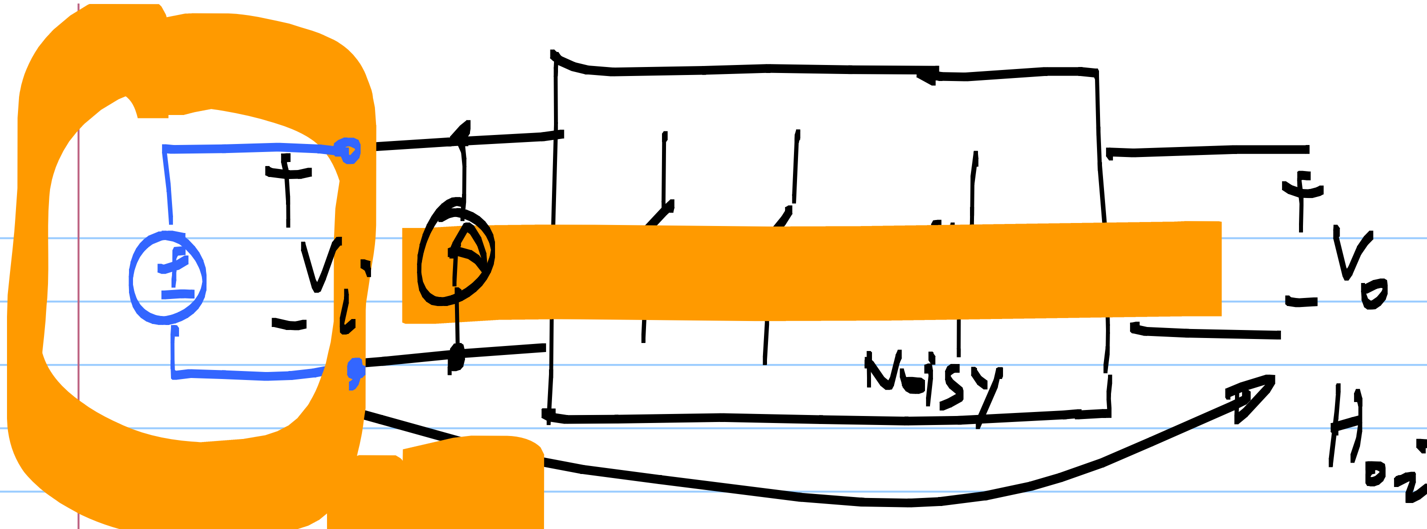
$2 \cdot 15^{-4}$ ✓ $\Rightarrow$ 0.2mV

$$\int_0^{\infty} 4kTR \cdot \frac{1}{1 + (2\pi f RC)^2} \cdot \frac{d(2\pi f RC)}{2\pi RC}$$

$$\left(\frac{\pi}{2} - 0\right) \cdot 4kTR \cdot \frac{1}{2\pi RC} = \boxed{\frac{kT}{C}}$$

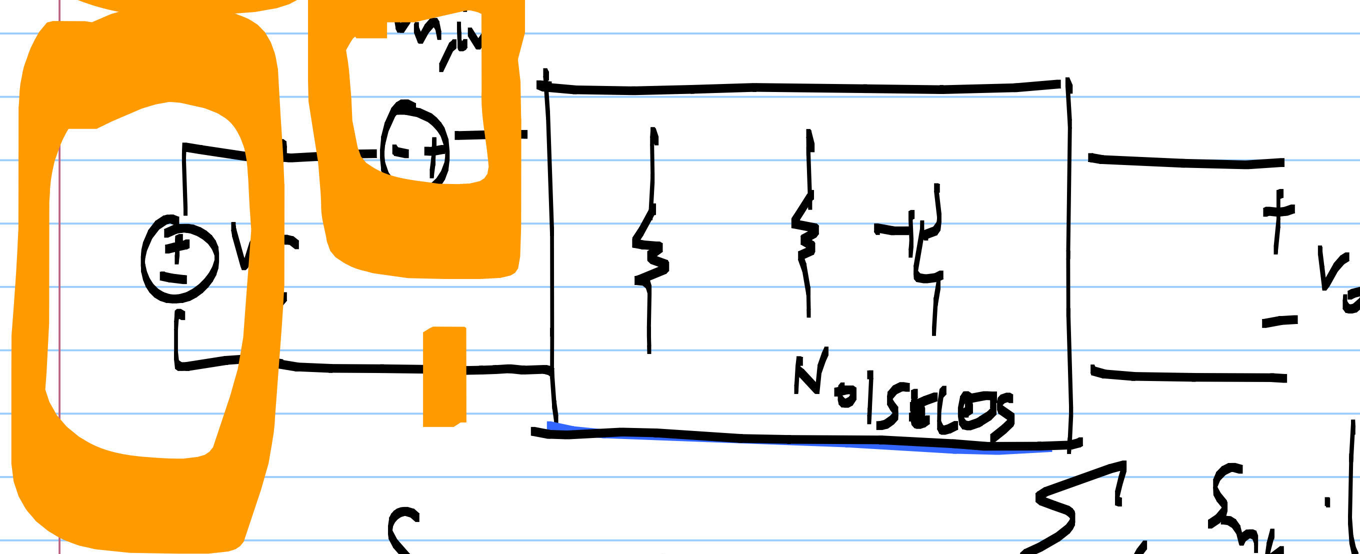
$$\frac{1}{2} C \overline{v^2} = \frac{kT}{2} \qquad \boxed{\frac{kT}{C}}$$





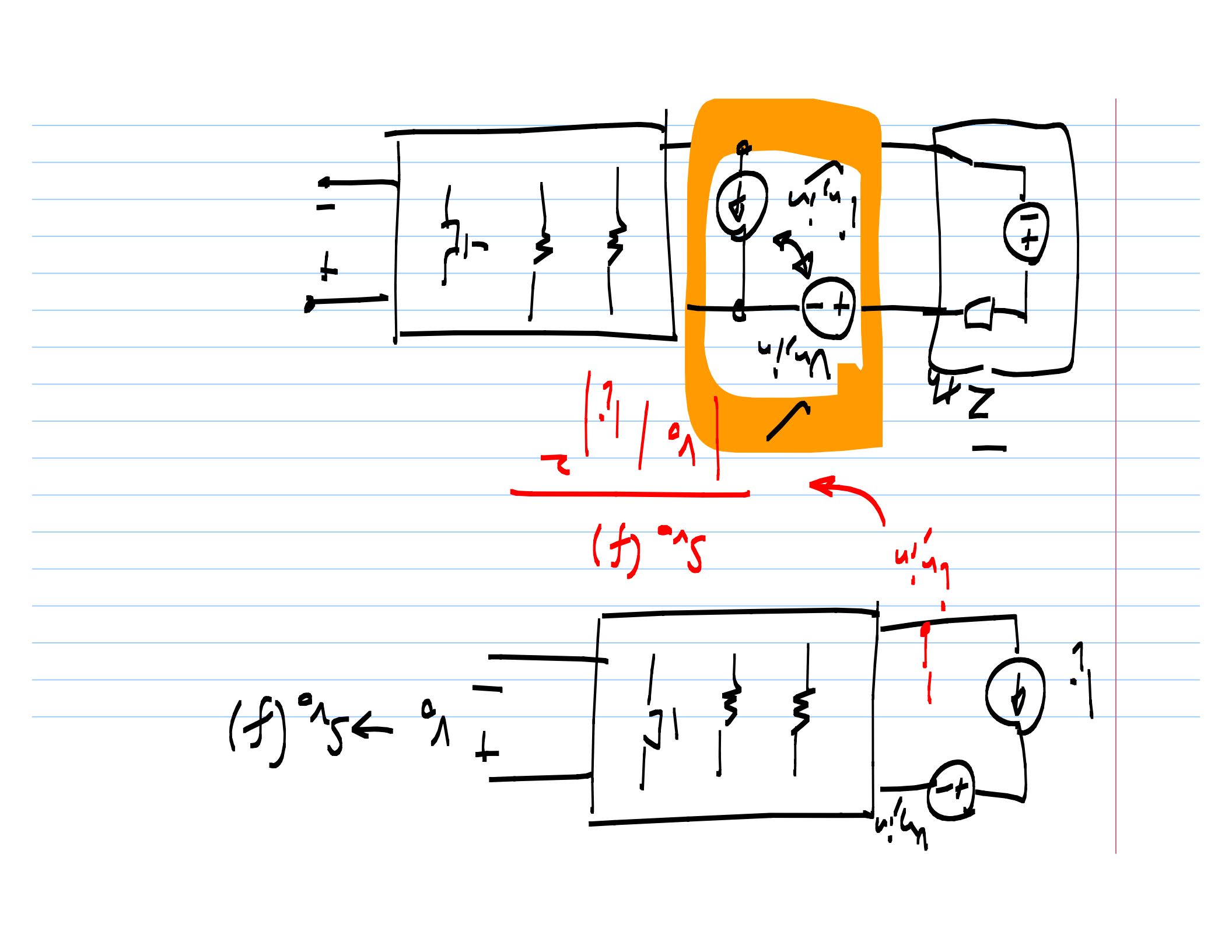
$$S_{v_o} = \sum_k S_{n_k} \cdot |H_{ok}|^2$$

$$\Vert$$

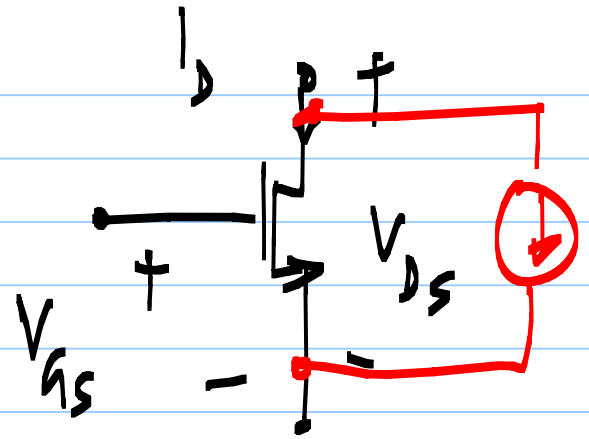


$$S_{v_{n,in}} \cdot |H_{oi}|^2$$

$$S_{v_{n,in}} = \frac{\sum_k S_{n_k} \cdot |H_{ok}|^2}{|H_{oi}|^2}$$


Z

$I_D = 0$ cutoff $\quad V_{GS} < V_T$



$$i_n = \mu_n C_{ox} \frac{W}{L} \cdot \left((V_{GS} - V_T) V_{DS} - \frac{V_{DS}^2}{2} \right)$$

triode / linear $\quad V_{GS} > V_T, \; V_{DS} < V_{GS} - V_T$

Sat. region

$$S_{i_n} = \frac{8}{3} kT \cdot g_m = \mu_n C_{ox} \frac{W}{2L} (V_{GS} - V_T)^2 \quad V_{GS} > V_T, \; V_{DS} > V_{GS} - V_T$$

saturation region

$$S_{i_R} = 4 \cdot kT \cdot G$$

$$S_{i_n} = 4kT \cdot \mu \frac{|Q_I|}{L^2}$$

Inversion charge

Sat:

$$|Q_I| = \frac{2}{3} C_{ox} WL (V_{GS} - V_T)$$