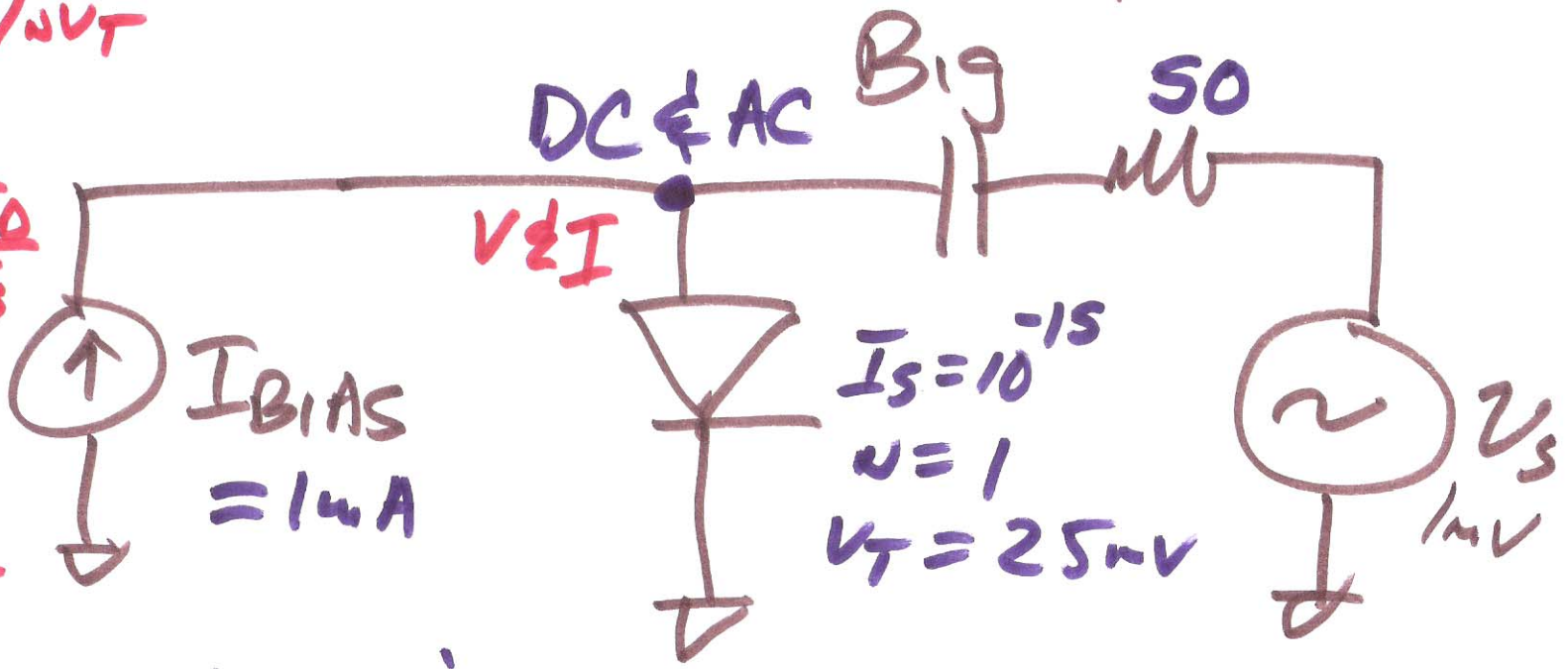
EE 320 Electronics

Lecture 10 2/25/13

$I_D \simeq I_S e^{V_D/nV_T}$

$V_D = nV_T \ln \frac{I_D}{I_S}$

$V_D = 1.25mV \cdot \ln \frac{10^{-3}}{10^{-15}}$



$V_D =$

$I_D + i_d = i_D$

$v_D = V_D + v_d$

DC AC

DC diode current

AC diode current

$I_D = 1mA$

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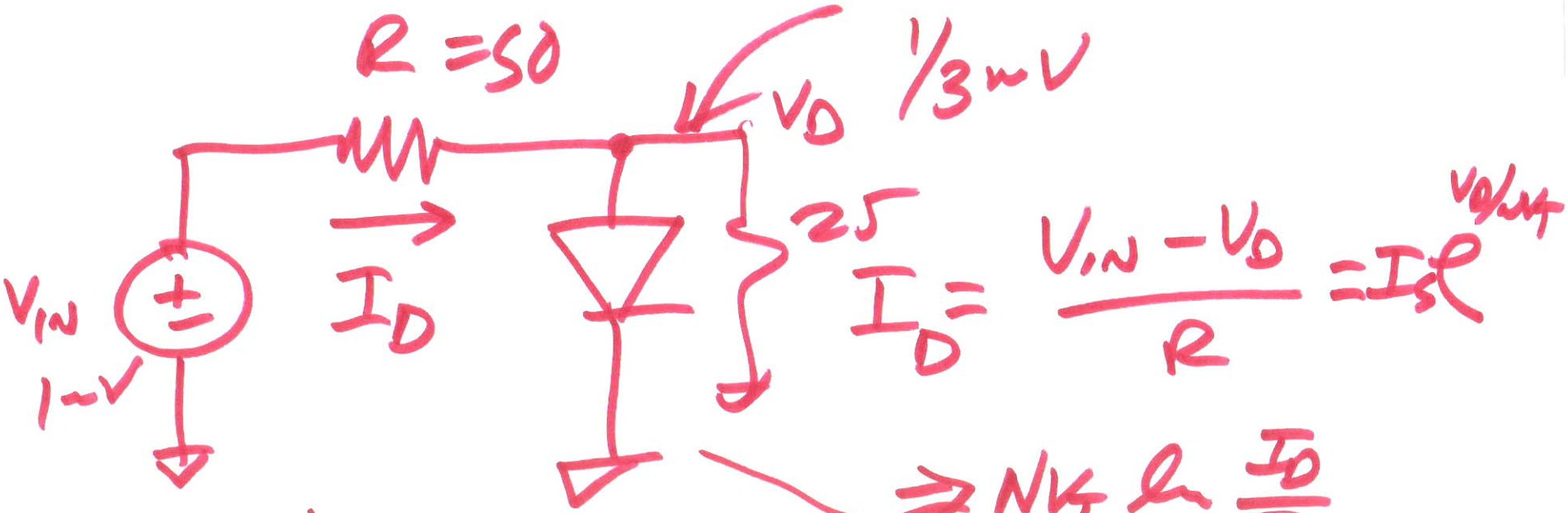

$$\Rightarrow nV_T \ln \frac{I_D}{I_S}$$

$$\frac{V_{IN} - V_D}{R} = I_S e^{V_D/nV_T}$$

D

L

R

L	R	V_D	diff

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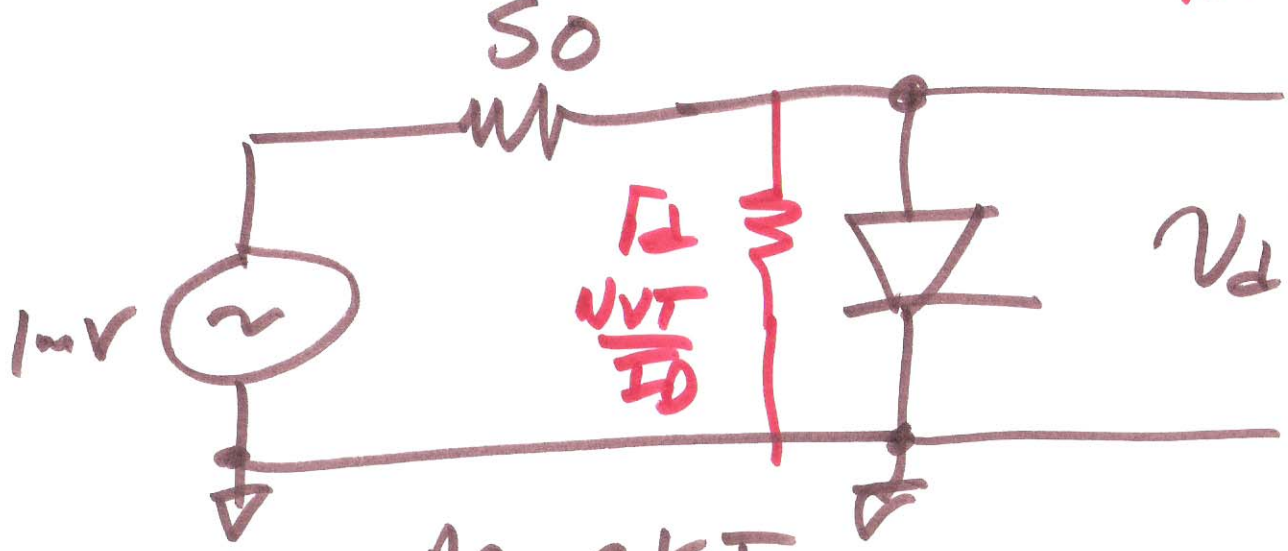
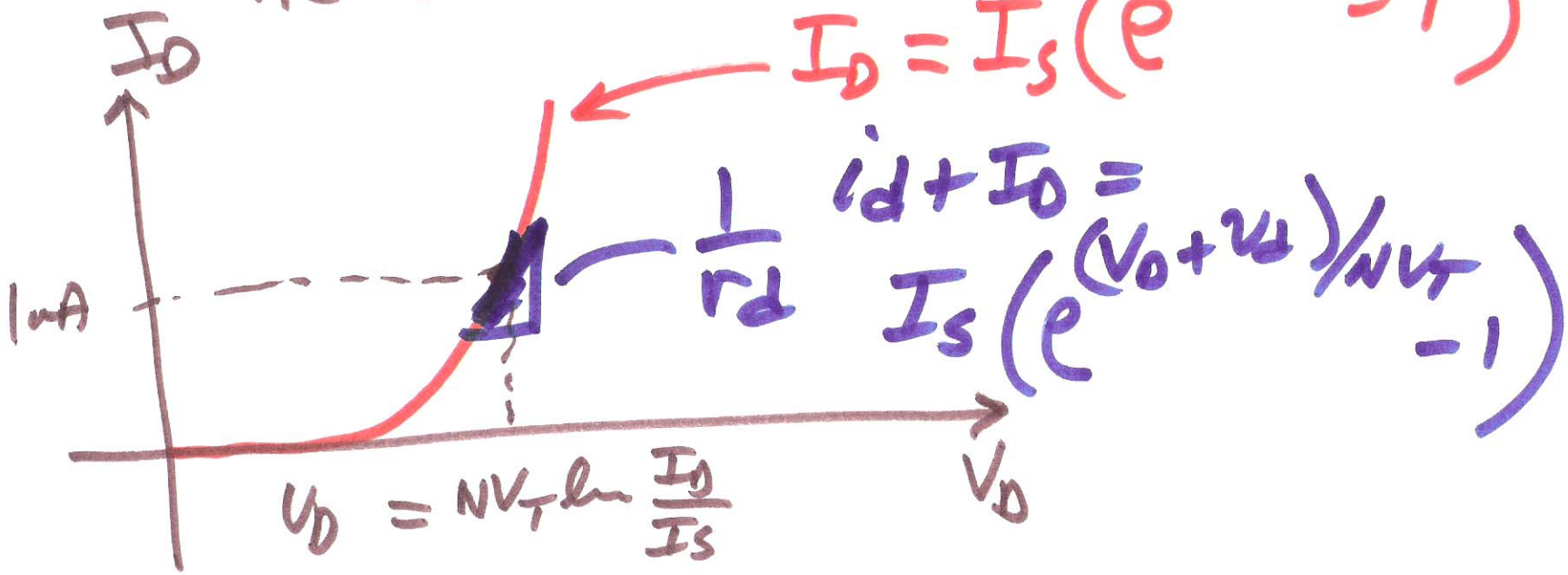
2)

$N=1$, $V_T = 25mV$

$I_D = 1mA$

$r_d = 25\Omega$





$$\frac{1}{r_d} = \left.\frac{\delta i_D}{\delta v_D}\right|_{\substack{I_D = \text{CONST} \\ V_D = \text{CONST}}} = \frac{\delta (I_D + i_d)}{\delta v_D}$$

$$= \left.\frac{\delta}{\delta v_D}\right|_{\substack{I_D = \text{CONST} \\ V_D = \text{CONST}}} I_S e^{v_D/NV_T}$$

$$= \frac{I_S}{NV_T} e^{v_D/NV_T} = \frac{I_S e^{\frac{V_D + v_d}{NV_T}}}{\leq I_D}$$

$V_D \gg v_d$

$$r_d = \frac{NV_T}{I_D}$$

$$\frac{1}{r_d} = \frac{I_D}{NV_T}$$

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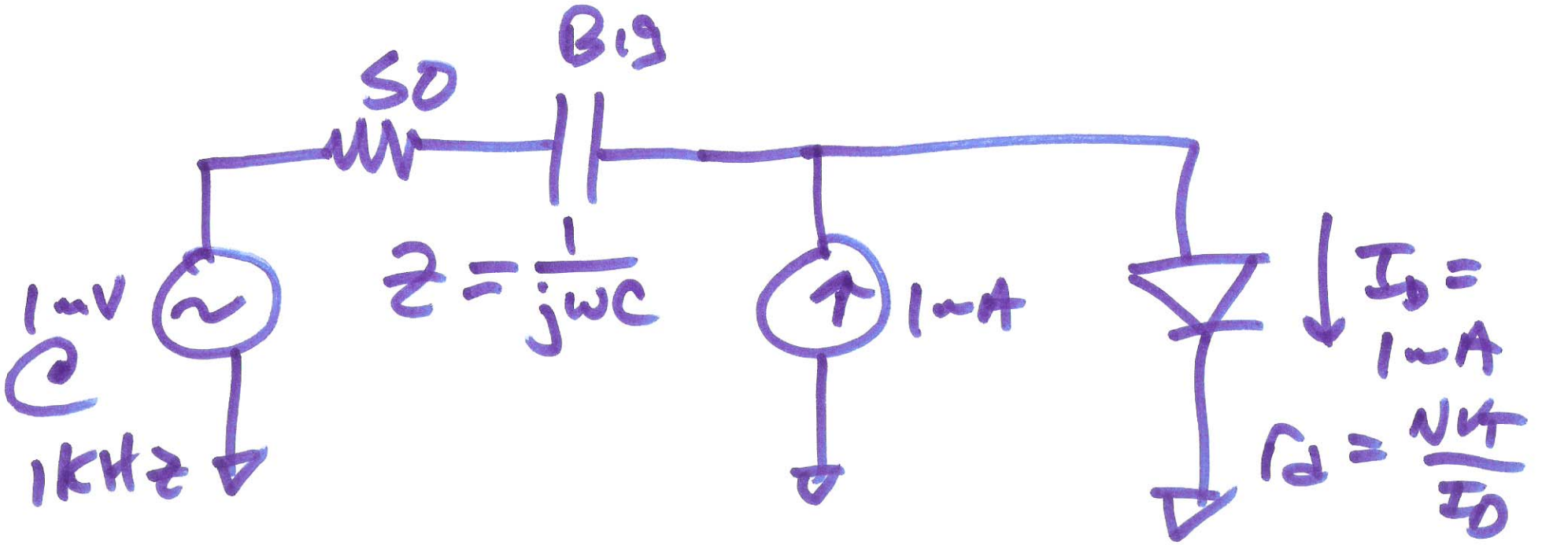
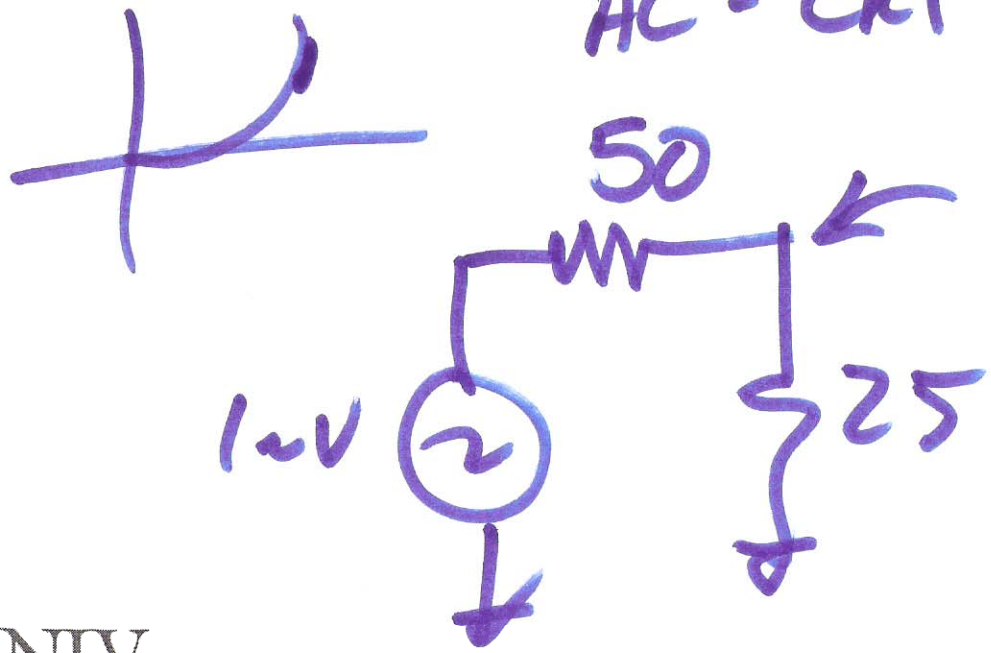


AC - CKT



$\frac{25}{50+25} \cdot 1mV$

$= \frac{1}{3} mV$

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$1mV = 10^{-3} V$

$dB = 20 \log 10^{-3}$

$= -60 dB$

$\frac{1}{2} mV \rightarrow -66 dB$

$\frac{1}{2} \rightarrow -6 dB$

$\times 2 \rightarrow 6 dB$

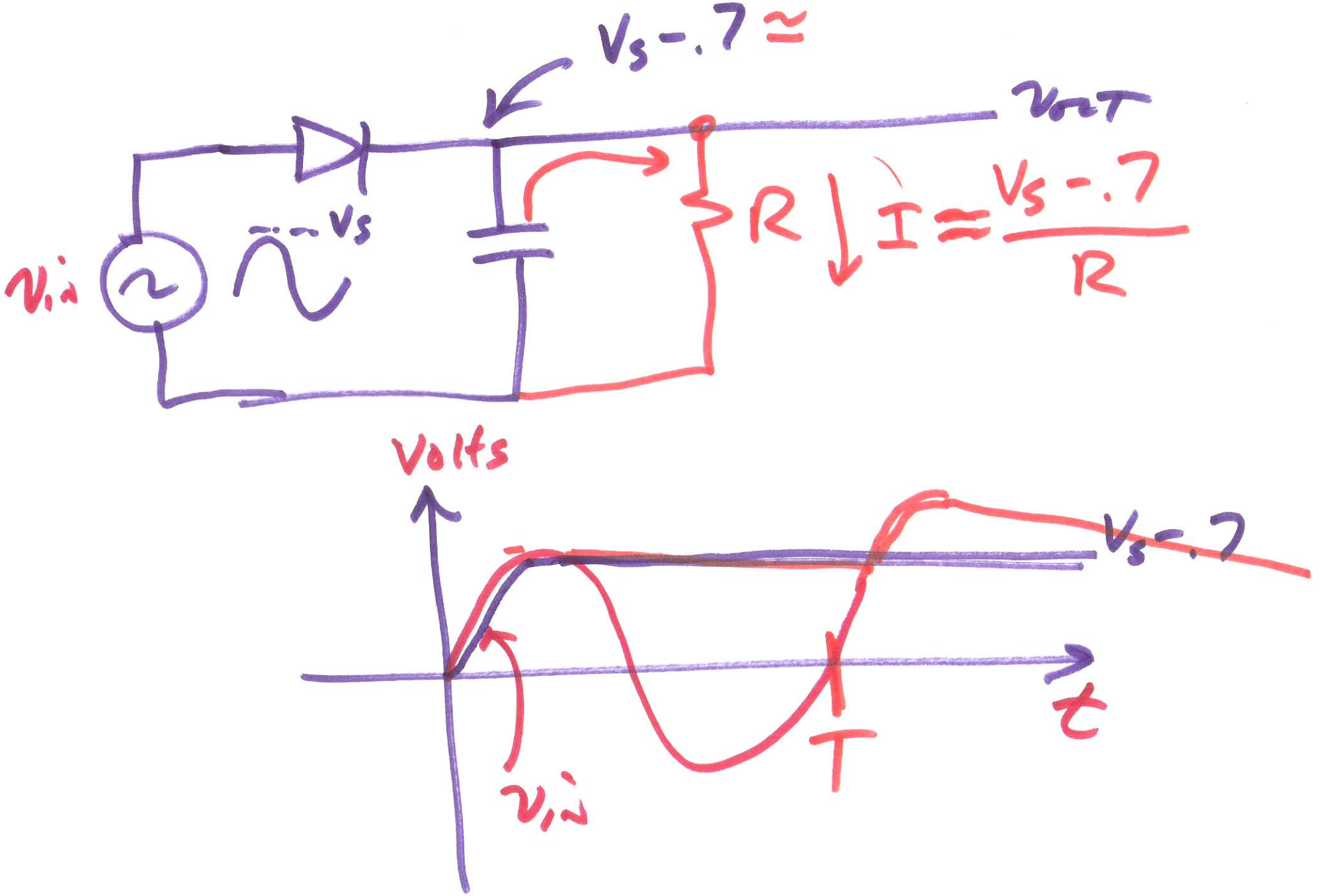
$\times 5 \rightarrow 14 dB$

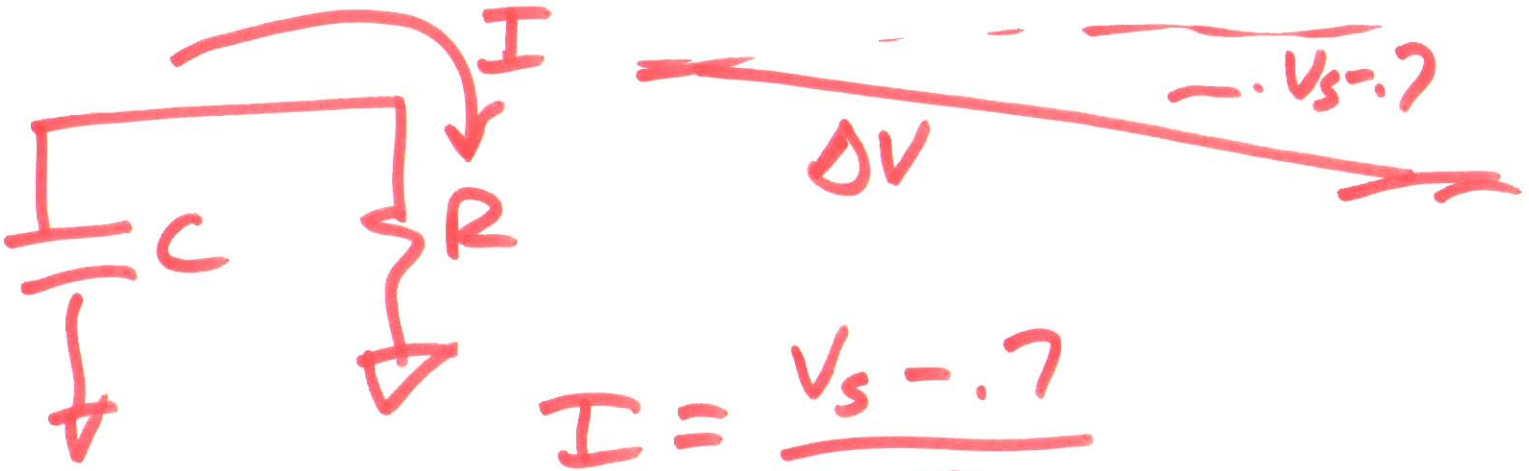
$\times 10 \rightarrow 20 dB$

$\times 20 \rightarrow 26 dB$

$\times 50 \rightarrow 34 dB$

$\times 100 \rightarrow 40 dB$


$V_S - .7 \simeq$
v_{out}
v_{in}
V_S
$R \downarrow I \simeq \frac{V_S - .7}{R}$
Volts
$V_S - .7$
v_{in}
T
t



$$I = \frac{V_S - .7}{R}$$

$\frac{\Delta V}{V} < 1\%$

$\Delta V < \frac{1}{5}\%$ of $5V$

$\Delta V \leq 50\,mV$

$$I = C\frac{dV}{dT} = \frac{V_S - V_D}{R} = C\frac{\Delta V}{\Delta T}$$

$$\Delta V = \frac{V_S - V_D}{R} \cdot \frac{I}{C} \cdot \frac{1}{f}$$

$$\Delta V = \frac{I_{L,MAX}}{f \cdot C}$$

$I_{L,MAX}$

$\Delta T = T$

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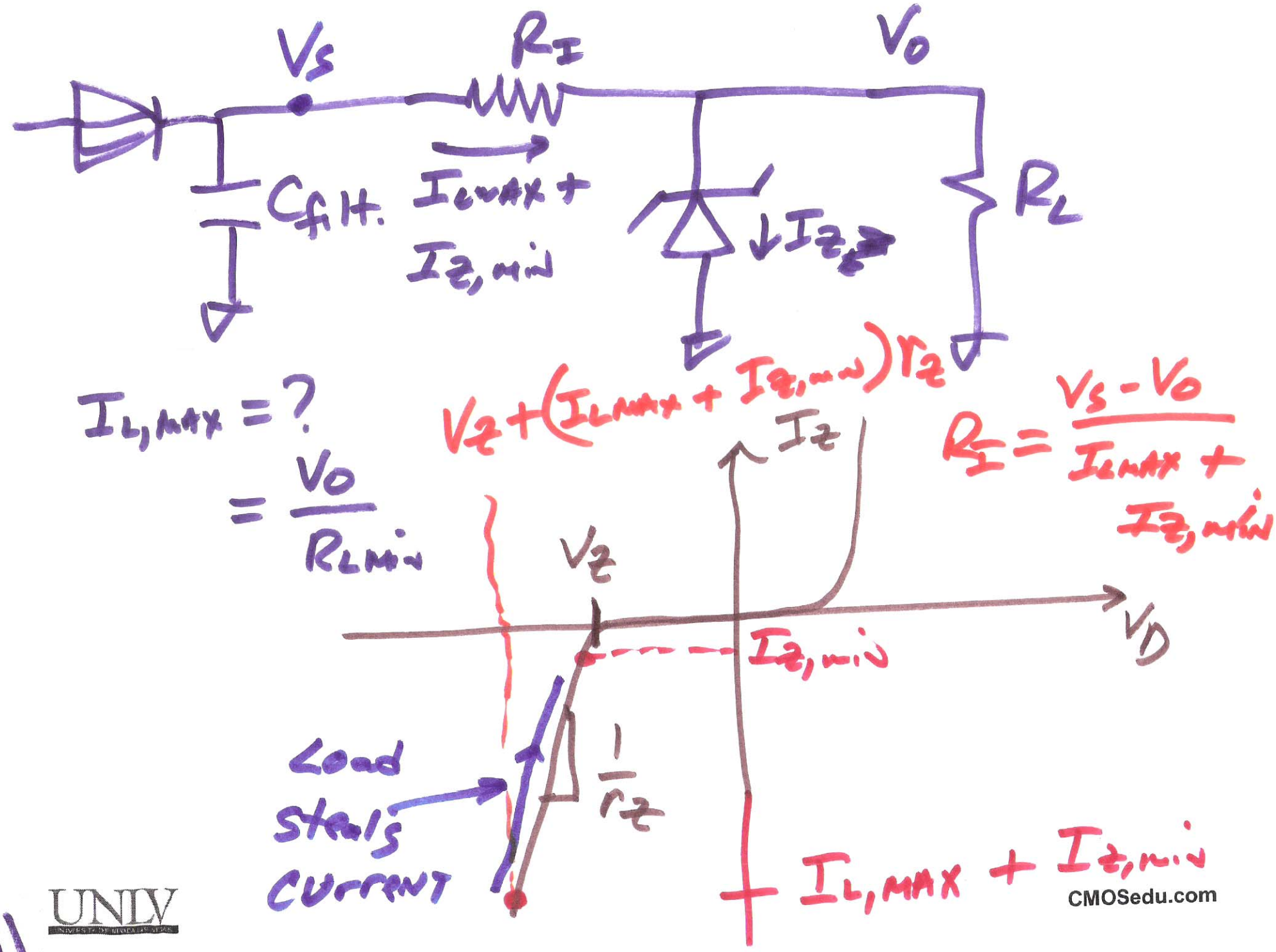
V_S
R_I
V_O
$C_{filt.}$
$I_{L,MAX} + I_{Z,min}$
I_Z
R_L
$I_{L,MAX} = ?$
$= \frac{V_O}{R_{L,min}}$
$V_Z + (I_{L,MAX} + I_{Z,min}) r_Z$
$R_I = \frac{V_S - V_O}{I_{L,MAX} + I_{Z,min}}$
I_Z
V_Z
V_O
$I_{Z,min}$
Load starts current
$\frac{1}{r_Z}$
$I_{L,MAX} + I_{Z,min}$

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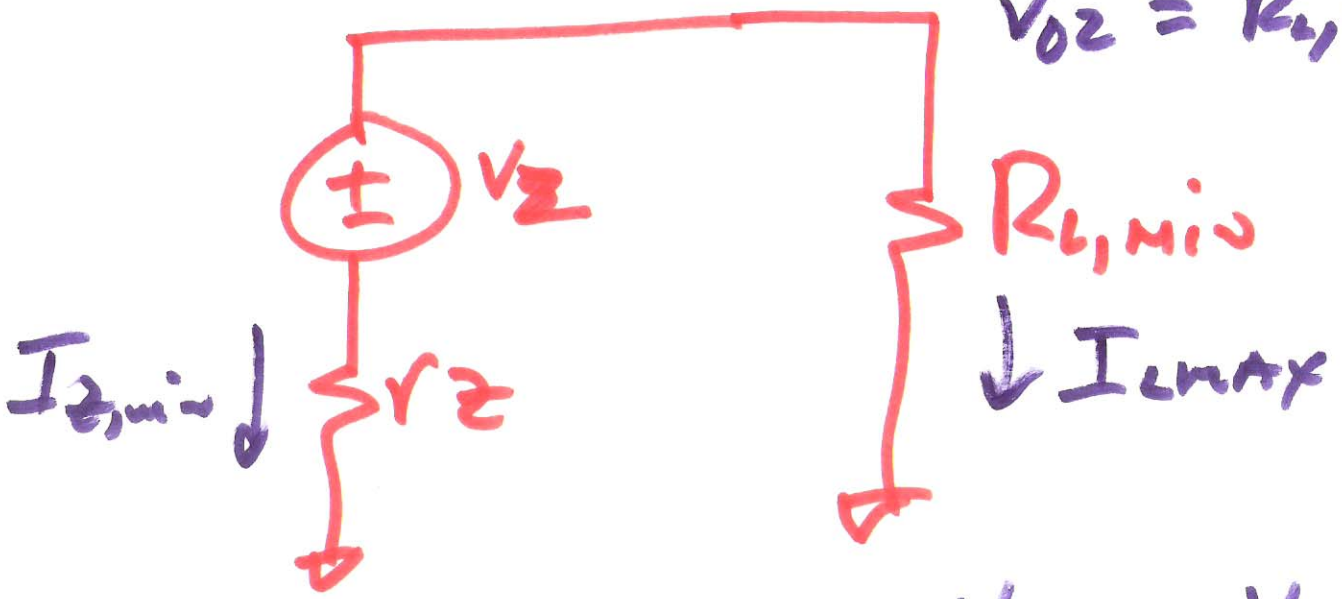
$$V_{O1} = V_Z + (I_{L,MAX} + I_{B,MIN}) r_Z$$

$$V_{O2} = R_{L,MIN} \cdot I_{L,MAX}$$



$$\Delta V = V_{O1} - V_{O2}$$

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