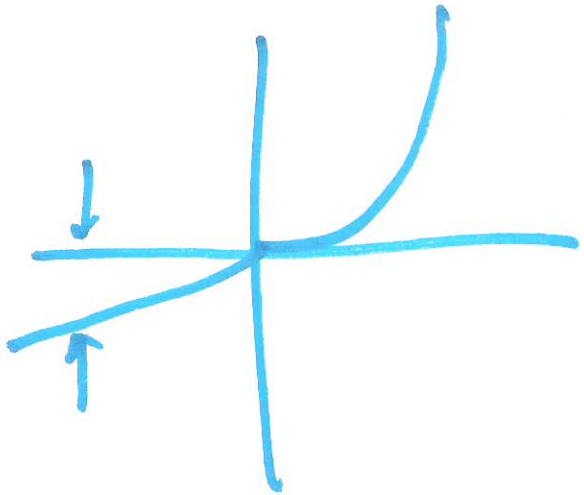
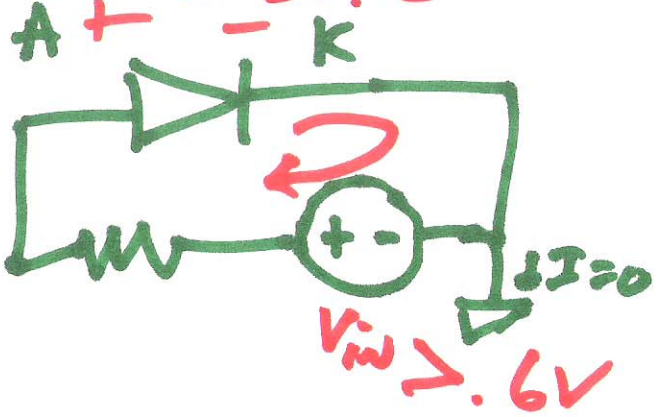
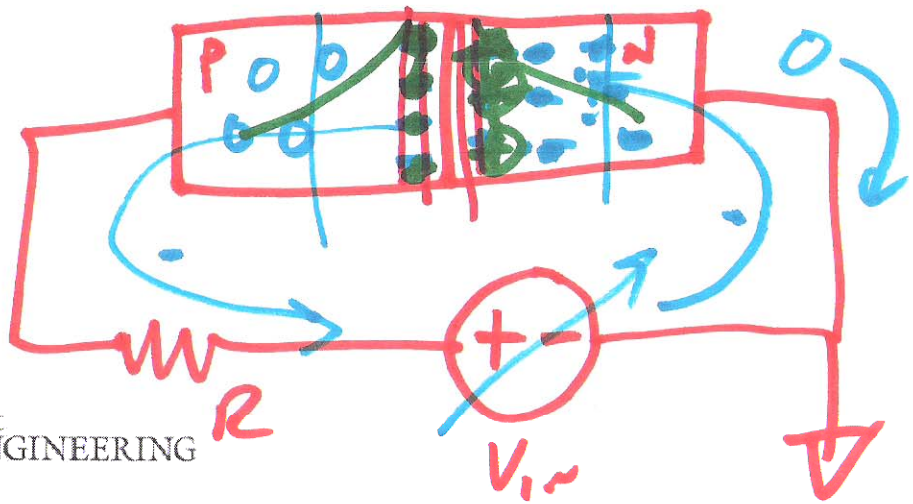
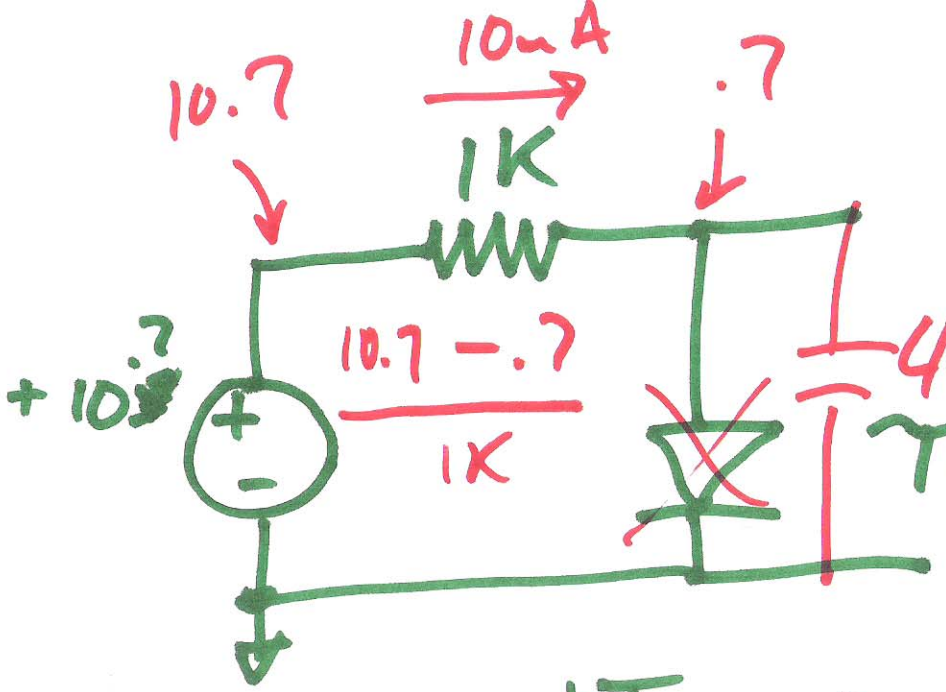
EE 320
Electronics I
Feb. 23, 2015
Vd Lecture 11









$r_d \cdot C_d = \tau_T$

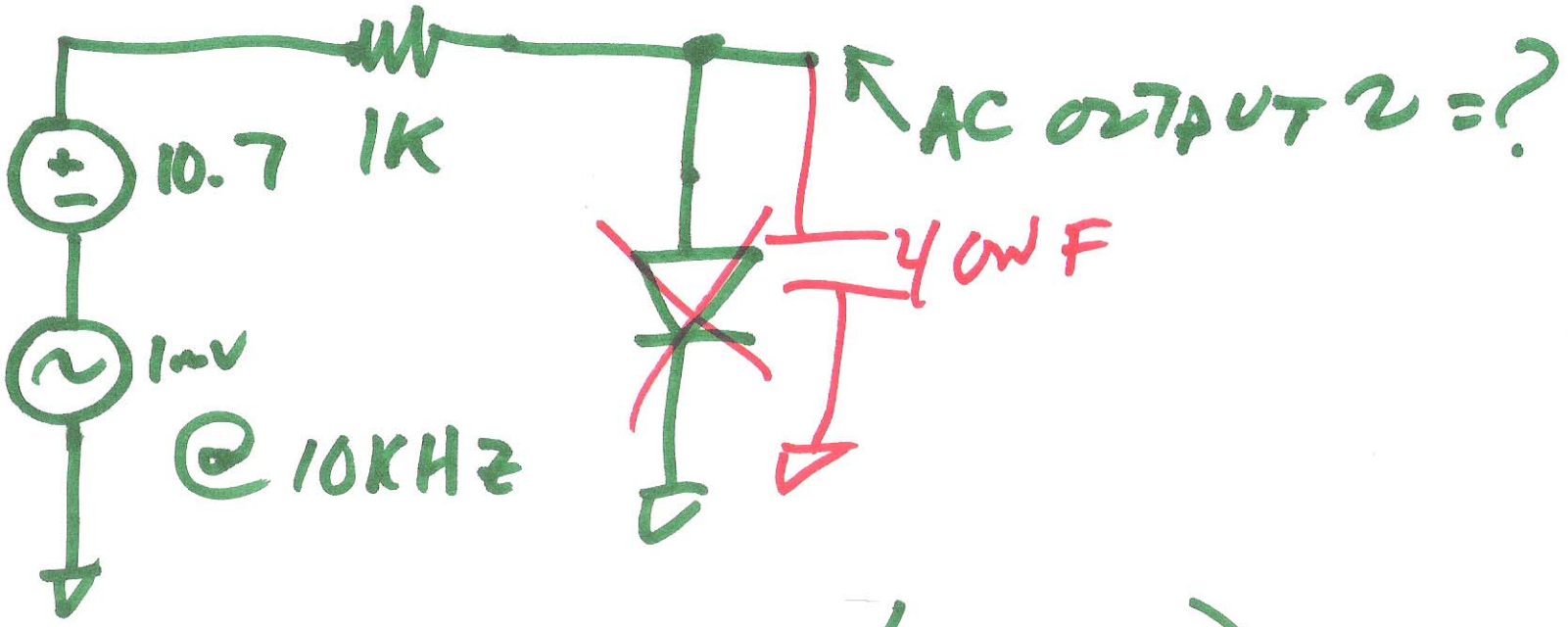
$r_d = \frac{.025}{10mA} = \frac{25mV}{10mA}$

$r_d = 2.5\Omega$

$V_T = \frac{kT}{q} \approx 25mV$ @ room Temp

$C_d = \frac{T_T}{r_d} = \frac{100ns}{2.5\Omega}$

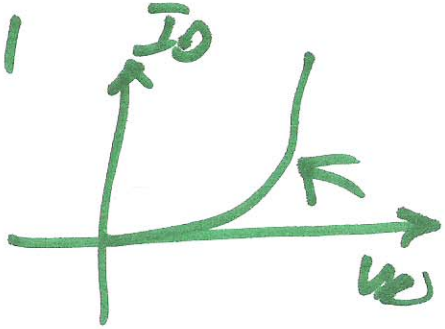
$C_d = 40\,NF$



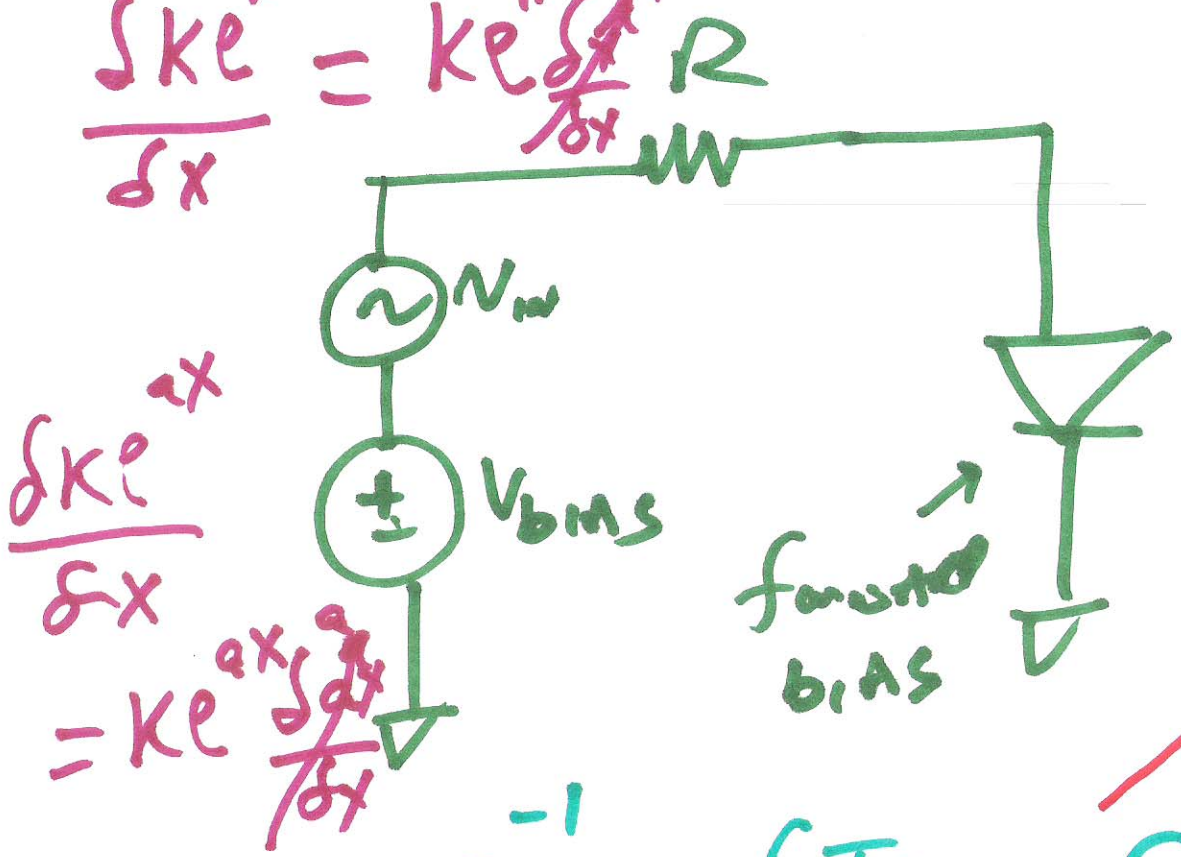
$$I_D = I_S\left(e^{V_D/NV_T} - 1\right)$$

Assume forward bias

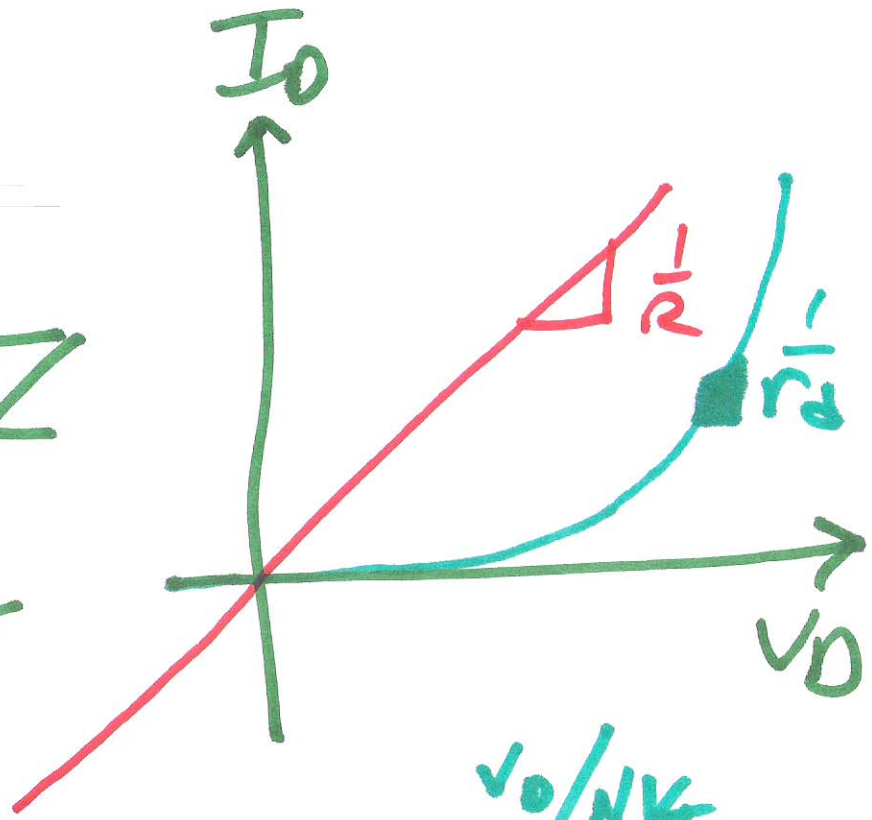
$$I_D \simeq I_S e^{V_D/NV_T} \qquad N = 1$$



$$\frac{\delta k e^{x}}{\delta x} = k e^{x}\frac{\delta x^{1}}{\delta x} R$$

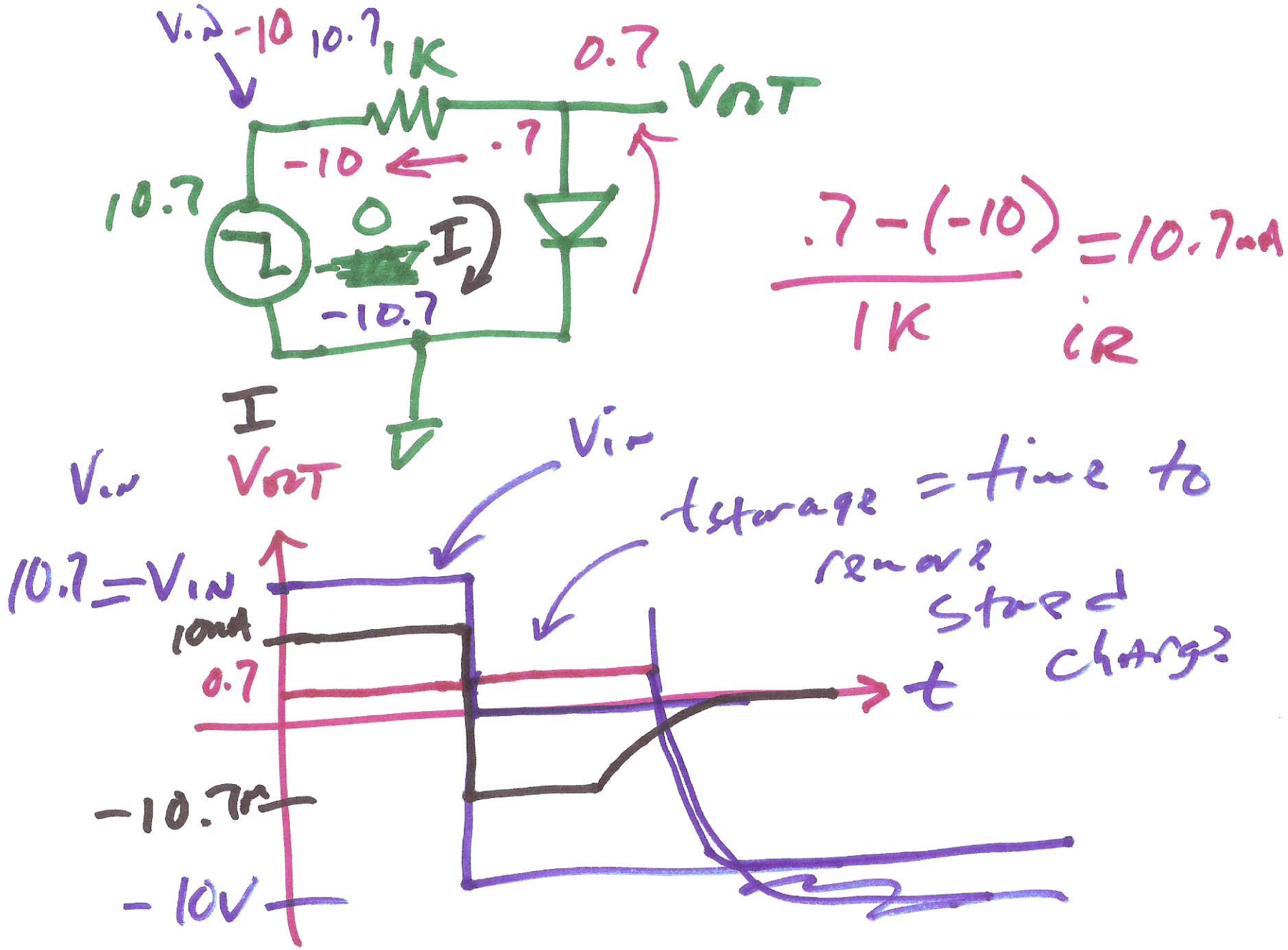


$$\frac{\delta k e^{ax}}{\delta x} = k e^{ax}\frac{\delta ax}{\delta x}$$



$$r_d^{-1} = \frac{\delta I_D}{\delta V_D} = \frac{\delta}{\delta V_D} I_S e^{V_D/NV_T}$$

$$r_d = \frac{NV_T}{I_D} \Leftarrow \frac{1}{r_d} = \frac{I}{NV_T} = \frac{I_S e^{V_D/NV_T}}{NV_T} \cdot \frac{\delta V_D/NV_T}{\delta V_D}$$


V.2 -10
10.7
1K
0.7
VOUT
-10
.7
10.7
0
I
-10.7
I
VOUT
Vin
VOUT
Vin
tstorage = time to remove stored charge
10.7 = VIN
10mA
0.7
-10.7mA
-10V
t
.7 - (-10) / 1K = 10.7mA
iR

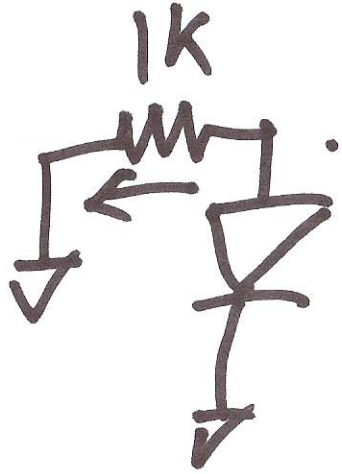
$$t_s = \tau_T \cdot \ln \frac{i_F - i_R}{-i_R}$$

$\tau_T = 100n$

$i_F = pos = 10mA$

$i_R = neg = -10.7mA \approx -2$

$$t_s = 100n \cdot \ln \frac{10 + 10.7}{10.7}$$



$t_s \simeq 70ns$

$i_R = -.7mA$