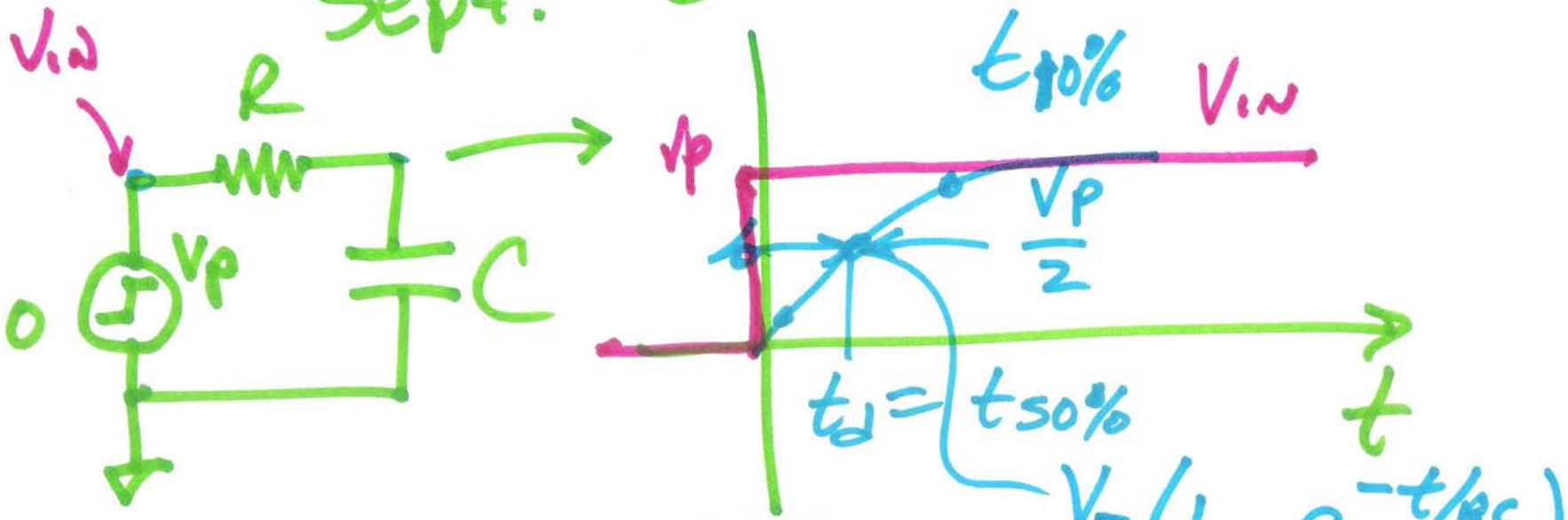
Lecture 4

EE 421 / ECG 621

Sept. 2

$t_r = t_{90\%} - t_{10\%}$

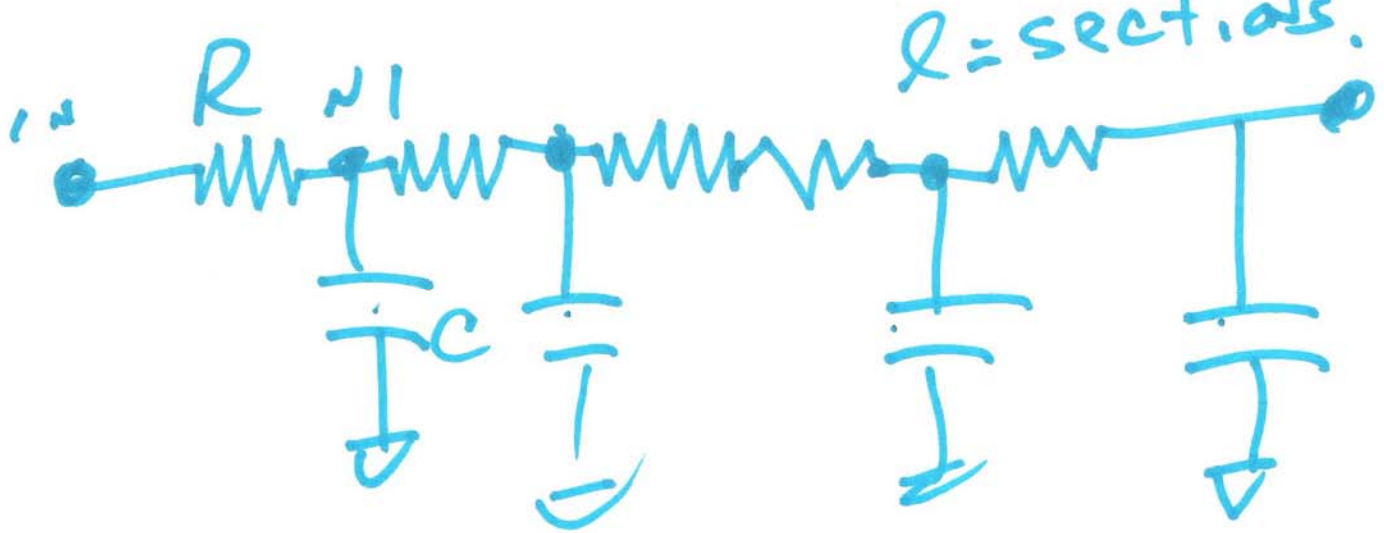
$t_{90\%} = 2.2RC$



$\frac{V_P}{2} = V_P(1-e^{-t/RC})$

$-\frac{1}{2} = -e^{-t/RC}$

$\boxed{t_d \approx 0.7RC}$



$$t_d = 0.7RC + 0.7 \cdot 2RC + 0.7 \cdot 3 \cdot RC$$

$$t_d = 0.7RC(1 + 2 + 3 + \ell)$$

$$\frac{\ell(\ell+1)}{2} \Big|_{\ell = Big} \approx \frac{\ell^2}{2}$$

$$t_d = 0.35RC\ell^2$$

2)

$1\mu \times 1\mu \Rightarrow 100\,aF = 100 \times 10^{-18} F$

$1\Omega \Rightarrow \frac{1K}{\square}$

1MEG - Resistor Minimum $W = 1\mu$

1,000 sq.

$\ell = 1{,}000$

$r = 1K$

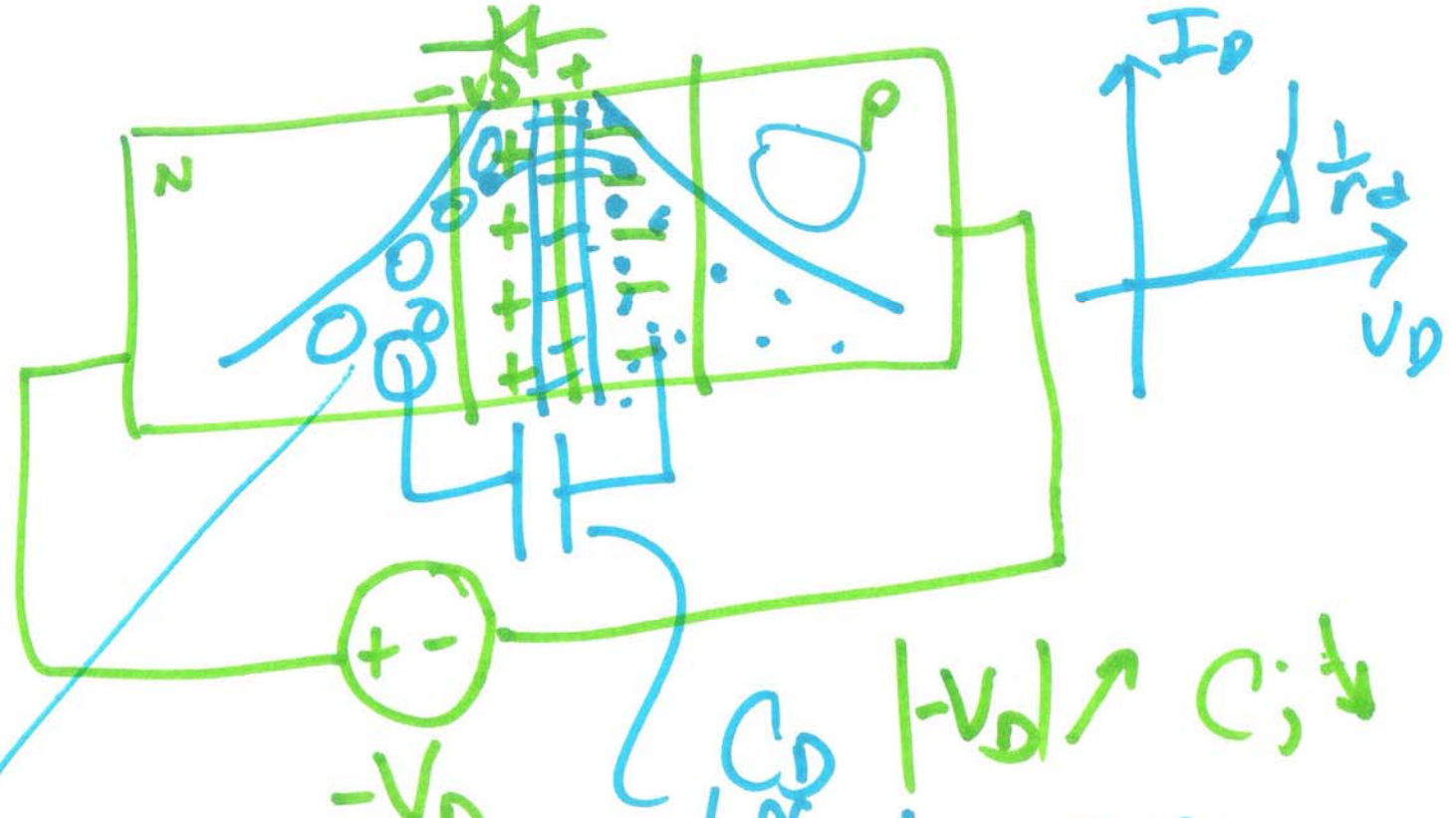
$t_d = 0.35 \cdot 1K \cdot 100 \cdot 10^{-18} \cdot 10^6$

(10^3, 10^2, ℓ^2)

$= 0.35 \times 10^{-7} s$

$= 35\,ns$

3)



C_D $|-V_D|$ ↗ C_j ↘

$-V_D$

diffusion CAP

τ_T

I_D = forward current that flows

$r_d \cdot C_D = \tau_T$, $r_d = \frac{N V_T}{I_D}$

4) $$C_D = \tau_T \cdot \frac{I_D}{N V_T}$$