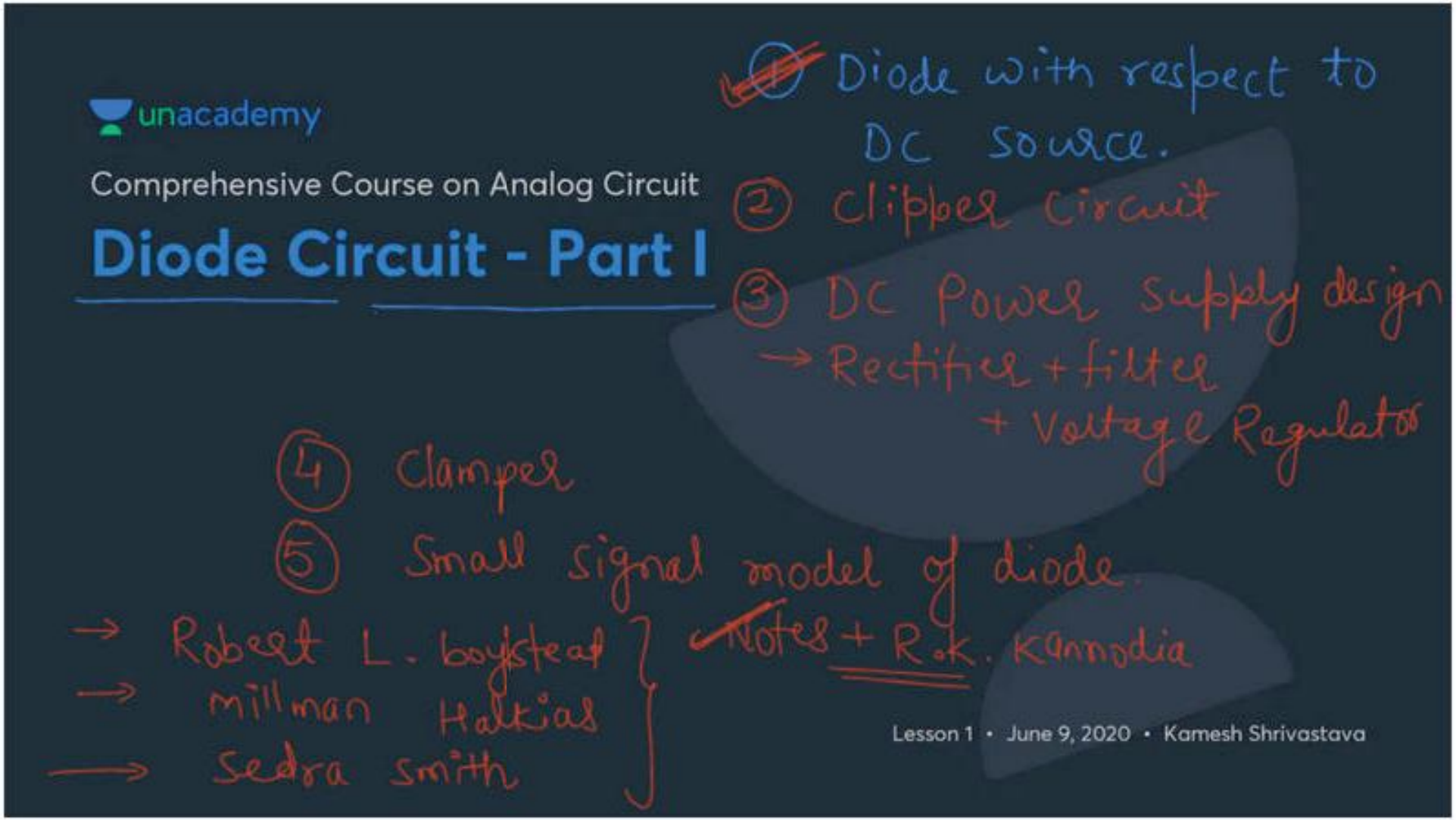
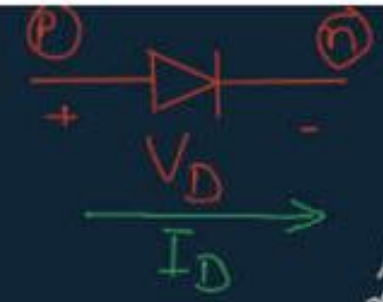
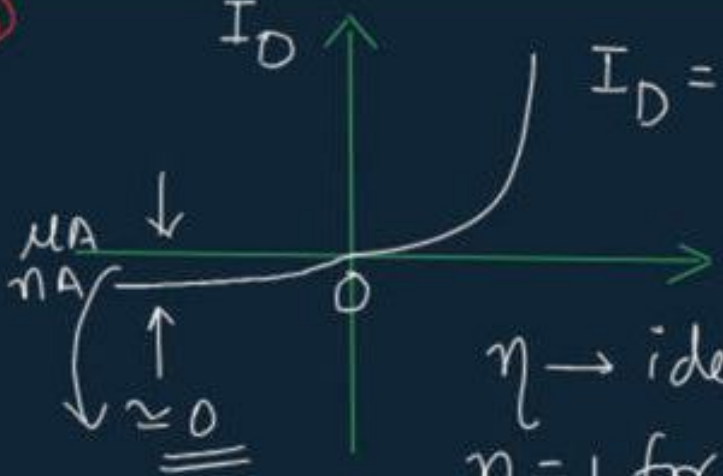

unacademy
Comprehensive Course on Analog Circuit
Diode Circuit - Part I
① Diode with respect to DC source.
② clipper Circuit
③ DC Power supply design
→ Rectifier + filter + Voltage Regulator
④ Clamper
⑤ Small signal model of diode.
→ Robert L. boylstead
→ millman Halkias
→ Sedra smith
Notes + R.k. Kanodia
Lesson 1 • June 9, 2020 • Kamesh Shrivastava

Diode:





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

$\eta \rightarrow$ ideality factor

$\eta = 1$ for Ge
$\eta = 2$ for Si
} Generally

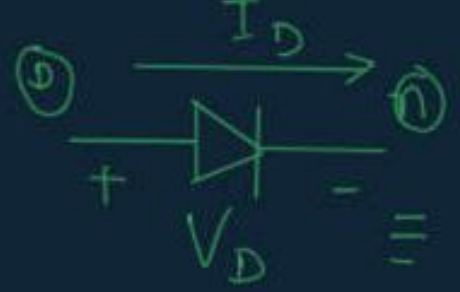
$V_T \rightarrow$ Thermal voltage

$V_T = T/11{,}600$ $\quad T \rightarrow$ Kelvin

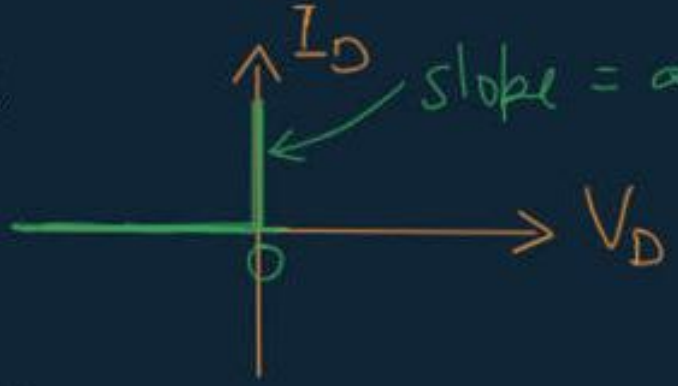
$I_S \rightarrow$ Reverse saturation current.

Diode Model :

① ideal diode :



$\equiv$

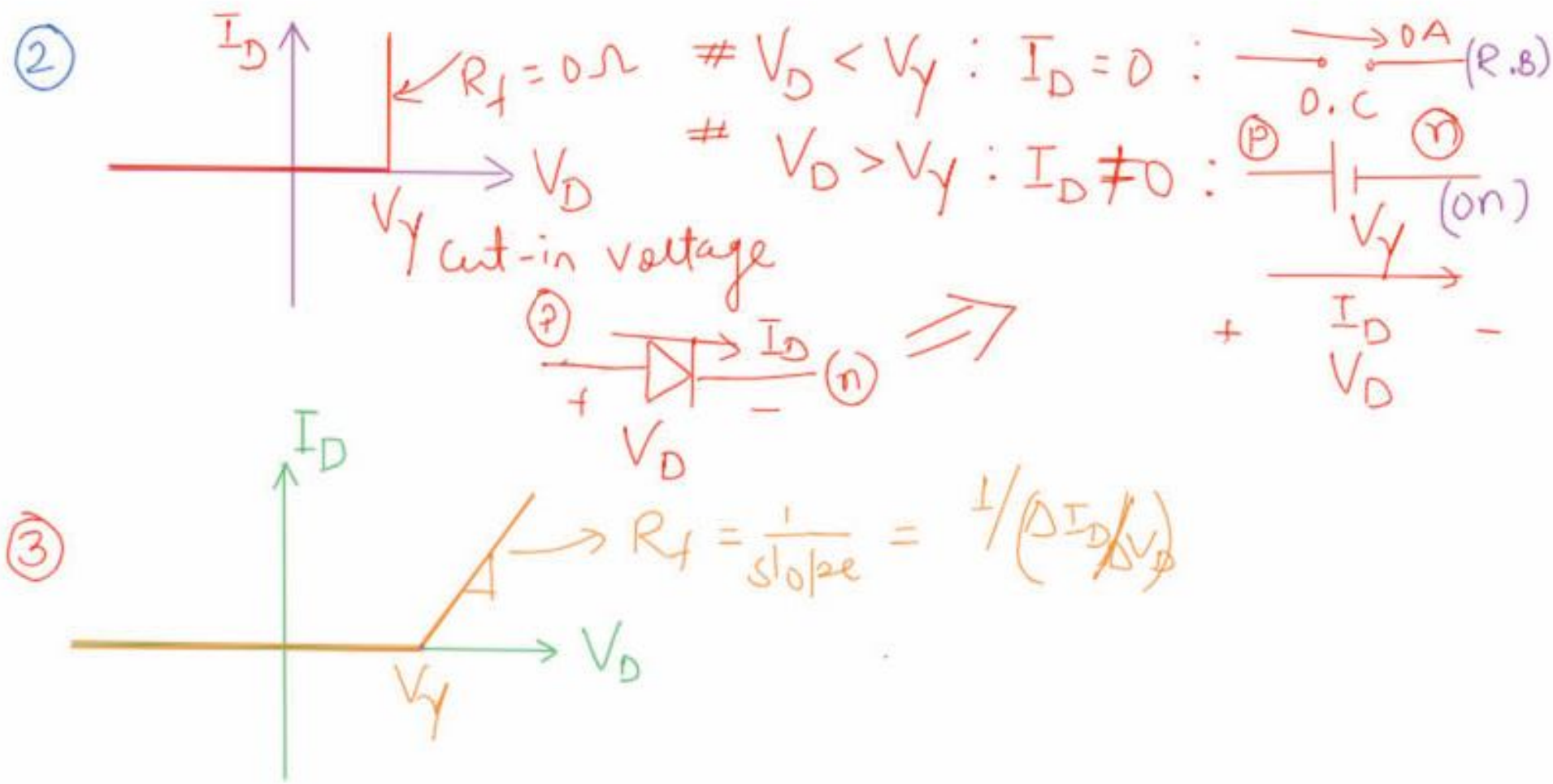


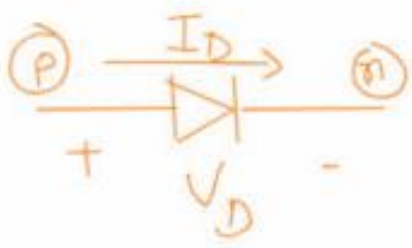
$r_f = 0\,\Omega$

$V_D < 0 : I_D = 0$: 1A (R.B) O.C.

$V_D > 0 : I_D \neq 0$: p n (f.B.) S.C $\rightarrow I_D$ ✓

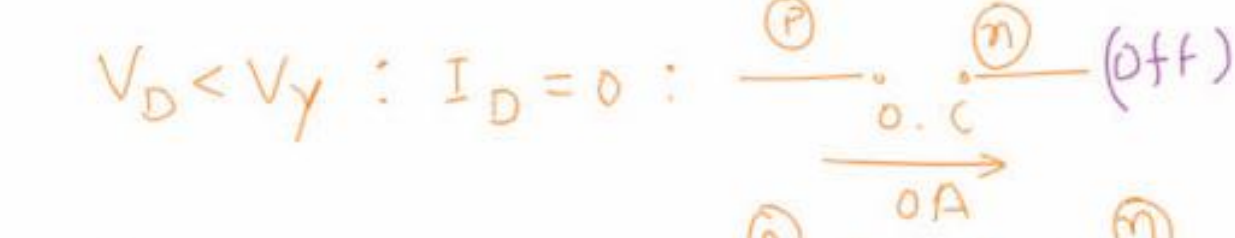
Diode application $\longrightarrow$ As a switch


②
I_D
$R_f = 0\Omega$
V_D
V_γ cut-in voltage
$V_D < V_\gamma$: $I_D = 0$: OA (R.B)
0.C
$V_D > V_\gamma$: $I_D \neq 0$:
(P) (n)
(on)
V_γ
I_D
V_D
+ −
(P) I_D (n)
+ V_D −
③
I_D
$R_f = \frac{1}{\text{slope}} = 1/(\Delta I_D/\Delta V_D)$
V_D
V_γ

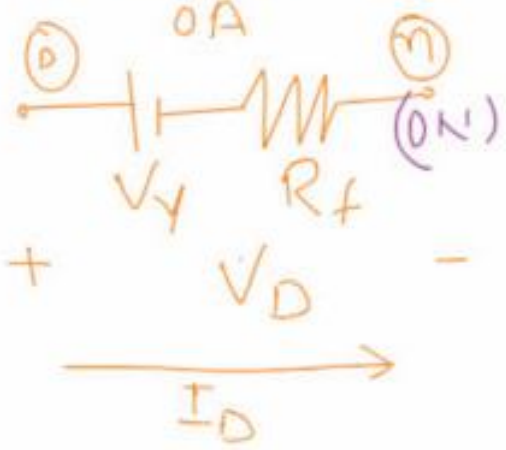


$\equiv$

$V_D < V_\gamma : I_D = 0 :$

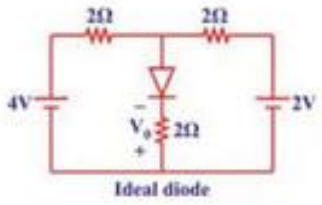


$V_D > V_\gamma : I_D \neq 0 :$



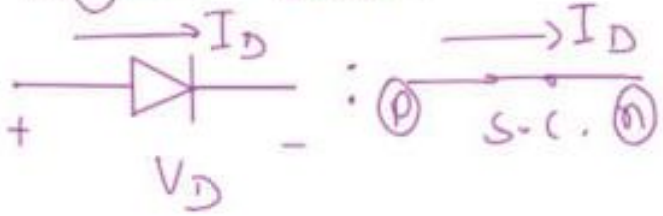
Q.1

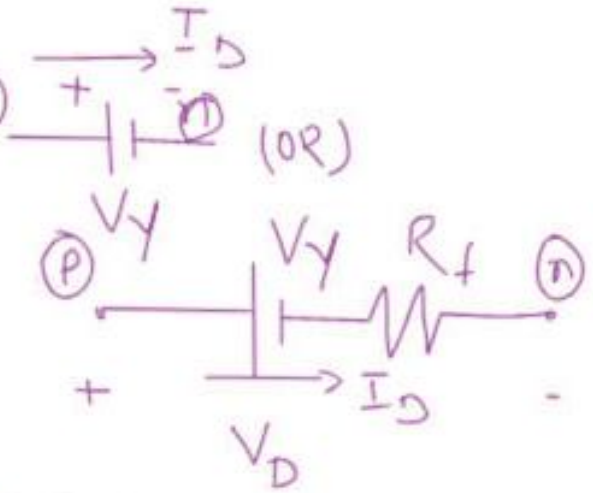
Find Vo



Procedure : (General)

#(1) Let diode ON





(2) find I_D

I_D (P to N) :⟶ F.B (ON)

I_D (N to P) ⋮⟶ R.B. (off)

(OR) 2nd Way:

① Let diode off

② If $V_D > 0$ (OR) $V_D > V_\gamma$ (OR) $V_D > V_\gamma$

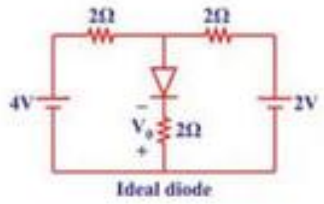
: Diode ON ✓

if $V_D < 0$ (OR) $V_D < V_\gamma$ (OR) $V_D < V_\gamma$

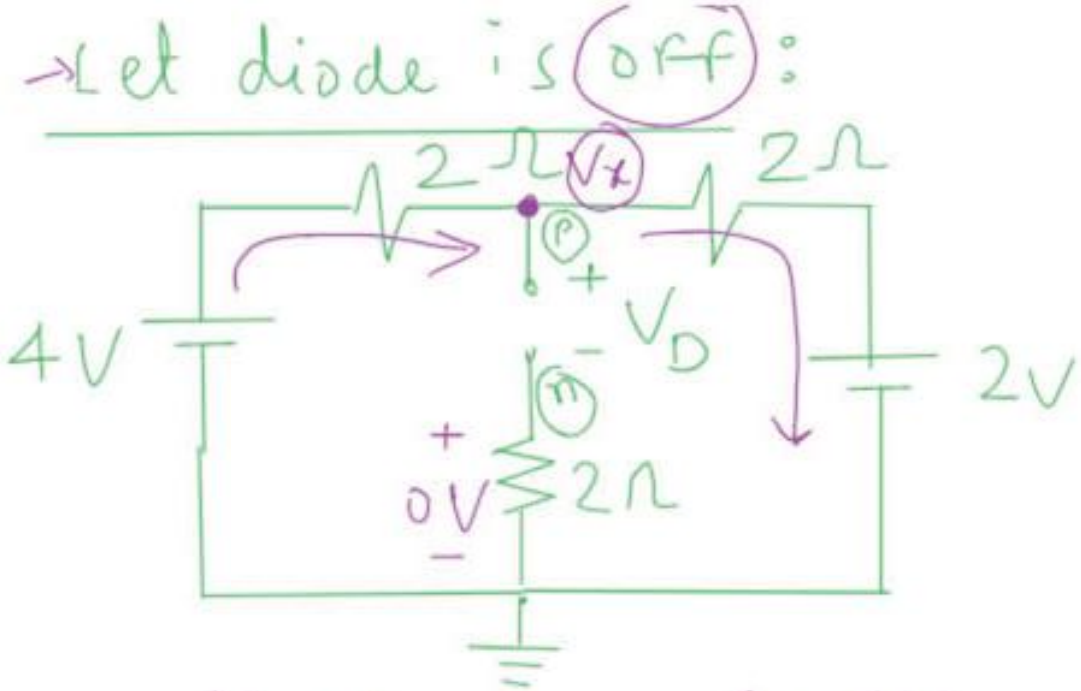
: Diode off

Q.1

Find Vo



→ Let diode is (off):



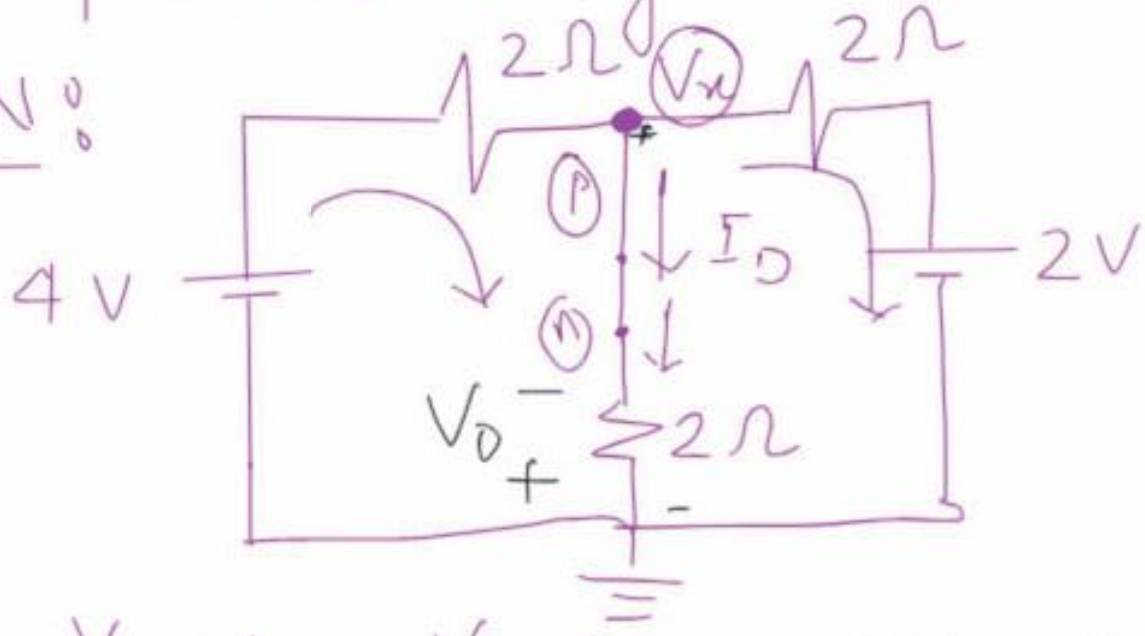
$$\frac{4 - V_x}{2} = 0 + \frac{V_x - 2}{2} \Rightarrow 6 = 2V_x$$

$$\boxed{V_x = 3V} = V_D$$

$V_D > 0$: (Diode ON)

our Assumption is wrong.

Diode ON!



$$\frac{4 - V_x}{2} = \frac{V_x - 0}{2} + \frac{V_x - 2}{2} \Rightarrow 3V_x = 6$$

$$\boxed{V_x = 2V}$$

$$I_D = \frac{V_x - 0}{2} = 1A \text{ (D to N)}$$

Really diode is ON.

$$V_o = -V_x = -2V \quad \text{Ans.}$$