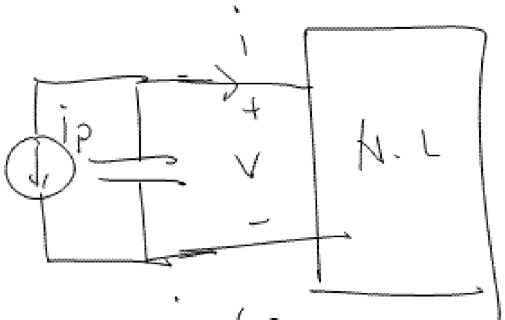
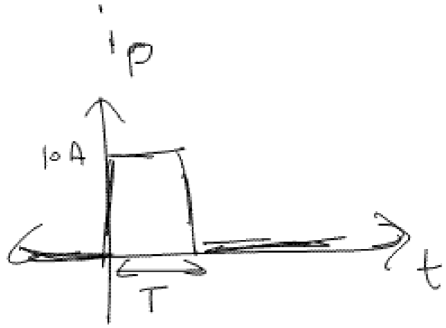
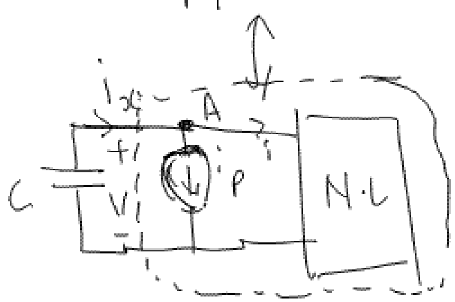
EE100 Discussion #7

(Q.1) Related to Flip-Flops (#3 From Sp05 MT II)



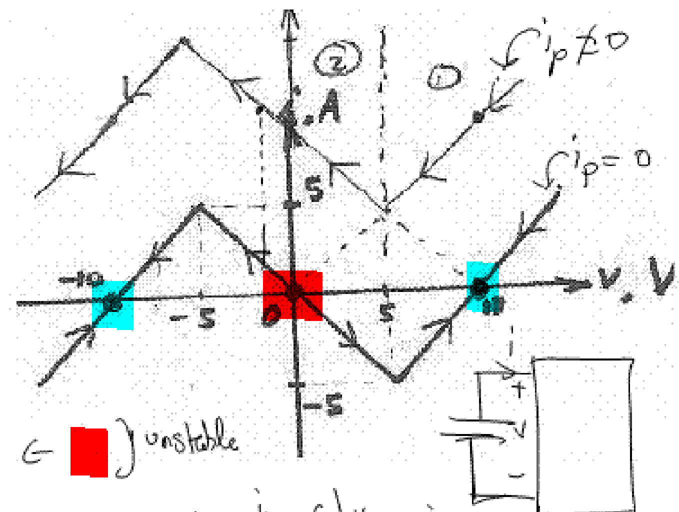




$i_x = i + i_p$

(KCL @ A)

$\Rightarrow \boxed{i_x = i + i_p}$



(0,0) ← } unstable

(10,0); (−10,0) ← } stable

$i = -C\frac{dv}{dt}$

$i_p = 0$

(Q:i) $\tau < 0$

(3) Consider the circuit shown in figure P6.23 (a) where N is described by the i-v characteristic shown in figure P6.23 (b).

i. Sketch the dynamic route.

ii. If $v_c(0) = 2$ V and $i_c(0) = -2$ mA; calculate and sketch i(t) and v(t) for $t \geq 0$.

$i_c = -i$

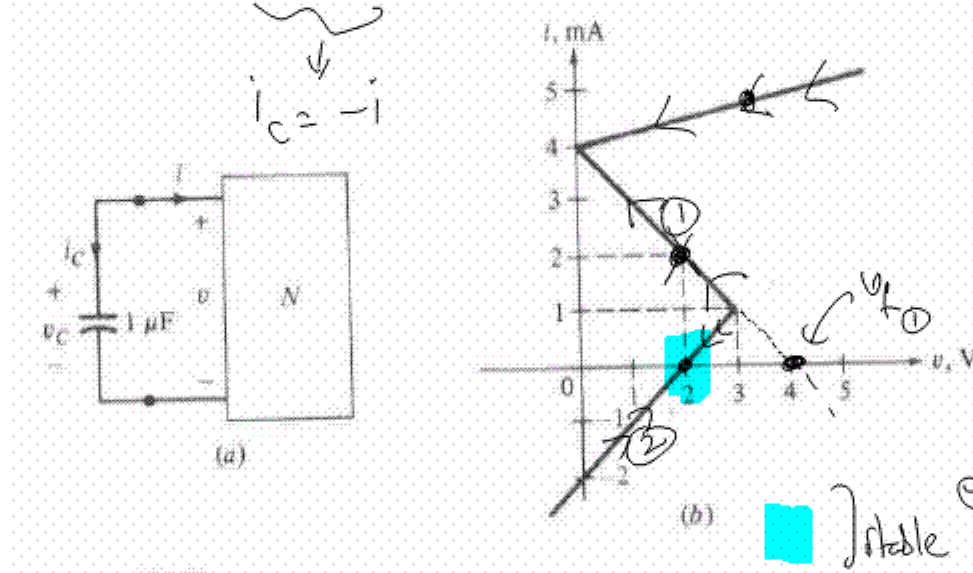


Figure P6.23

$i = -C\dfrac{dv}{dt}$

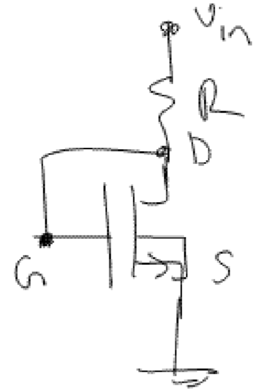
$i > 0,\ v' < 0$ | $i < 0,\ v' > 0$

] stable eq. points: $\dfrac{dv}{dt} = 0 \Rightarrow \boxed{i = 0}$

$$v(t) = V_f + (v_i - v_f)e^{-t/\tau}$$

$$= V_f + (v_i - v_f)e^{t/\tau} \quad (\tau < 0)$$

(Q:)



POINT! Nmos is always saturated!

Note: $V_{GS} = V_{DS}$ because of feedback.

Now, if Nmos is saturated:

$V_{DS} \geq V_{GS} - V_{T0}$

$\Rightarrow V_{GS} \geq V_{GS} - V_{T0}$

(Triode)

$V_{DS} \leq V_{GS} - V_{T0}$

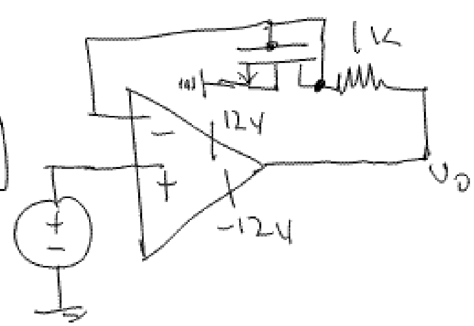
~~$\Rightarrow V_{GS} \leq V_{GS} - V_{T0}$~~

impossible!

(Q:) Find V_0

$\frac{W}{L} = 1$ $K_P = 50 \frac{\mu A}{V^2}$

$V_{T0} = 1V$



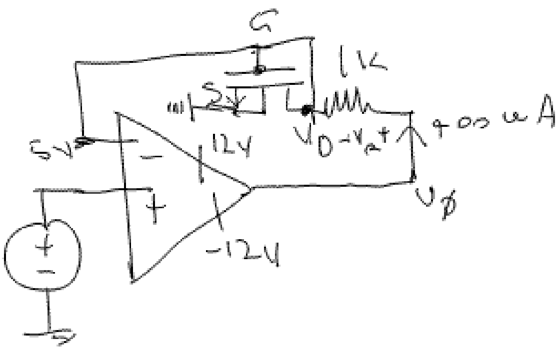
Two things

↳ (1) Mode of operation of the Nmos

↳ (2) Is op-amp railing?

(A 1): Nmos is always saturated (gate connected to drain)

(A 2): Assume op-amp is linear.



∴ $V_p = V_n = 5V$

∴ $V_G = V_D = 5V$

Since Nmos is saturated: $I_{DS} = K(V_{GS} - V_{TO})^2$

$$= \frac{1}{2}(KP)\left(\frac{W}{L}\right)\left[V_{GS} - V_{TO}\right]^2$$

$$= \frac{1}{2} \cdot 50 \frac{uA}{V^2} (5-1)^2$$

$$= 400\ uA$$

∴ $V_o = V_\phi = V_R + V_D \Rightarrow V_o = (I_{DS})(1K) + 5V \Rightarrow \boxed{V_o = 5.4V}$