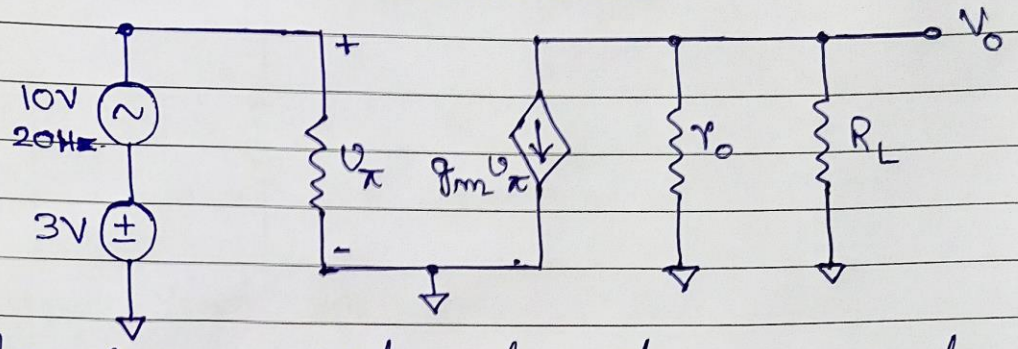
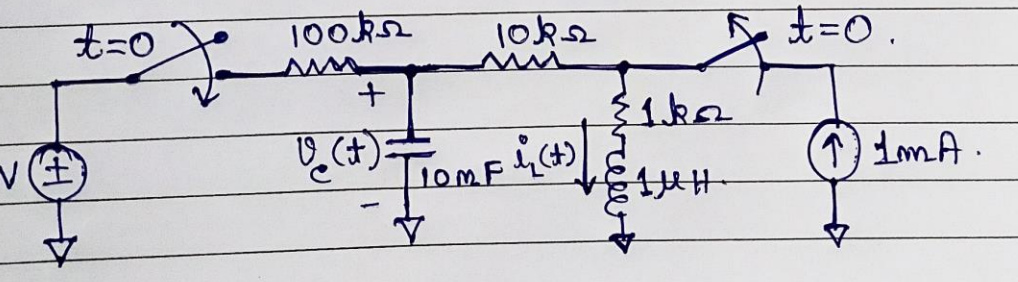
Problem set



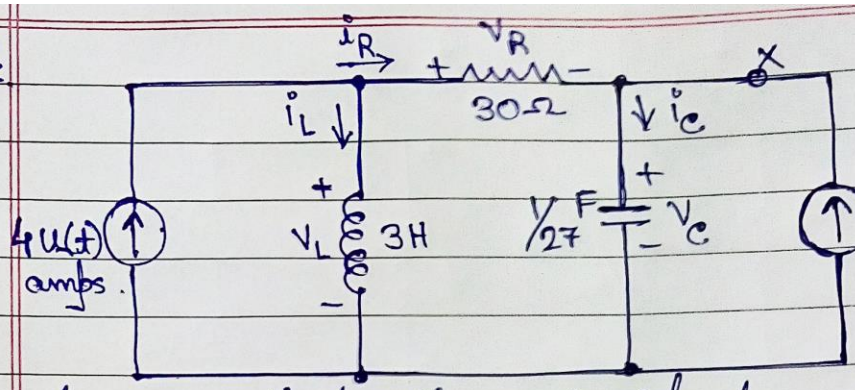
The given circuit represents a very basic model of a FET. It operates on the principle of voltage dependent current sources where the drain current is directly dependent on the gate-source voltage. Transconductance (g_m) is a parameter that defines the current dependency on the voltage. It has an unit of $(\frac{I}{V})$. Here, if $g_m = 10mS^{-1}$, $v_\pi = 100k\Omega$, $r_o = 200k\Omega$, $R_L = 10k\Omega$, find the output voltage v_o manually as well as in SPICE. If there is a capacitive load $C_L = 100\mu F$ in parallel with R_L, find the time required to charge it to maximum (in SPICE, as well as manually). [5+5 = 10]



Determine the value of $v_c(t)$ and $i_L(t)$ long time after the event of switching [in SPICE as well as manually]. [5+5 = 10]

→ BONUS: In practical circuits where high voltage switching occurs, why is it always advisable to place a capacitor across a switch.

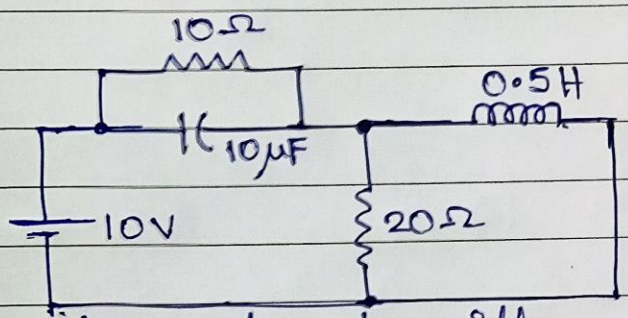
2)



Assume that the circuit has been in this situation for a long time. Find $\left.\frac{dv_c}{dt}\right|_{t=0^+}$ [in SPICE and manually.]

[5+5 = 10].

3)



At time $t = 0^+$ with zero initial condition, voltage across the 20Ω resistor is ?

[in SPICE and manually.] [5+5 = 10].