EE210: Analog Electronics - Quiz 4

NAME (in capital)	Roll No

Time: 15 minutes

1) : For the transistor in the following circuit $\mu_n C_{ox} = 200\mu A/V^2$, $V_{tn} = 1V$, $W/L = 10$, $I_{DC} = 1mA$. Also, $V_{DD} = 6V$, $V_B = 4V$.

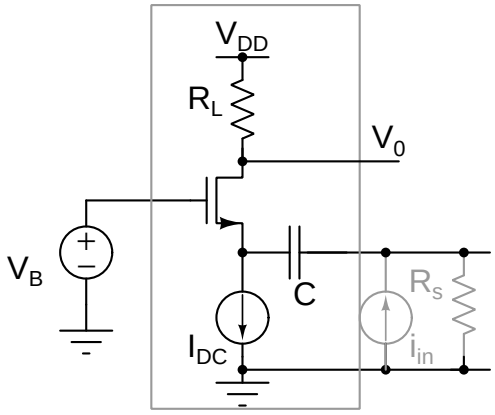


Fig. 1. Problem 1

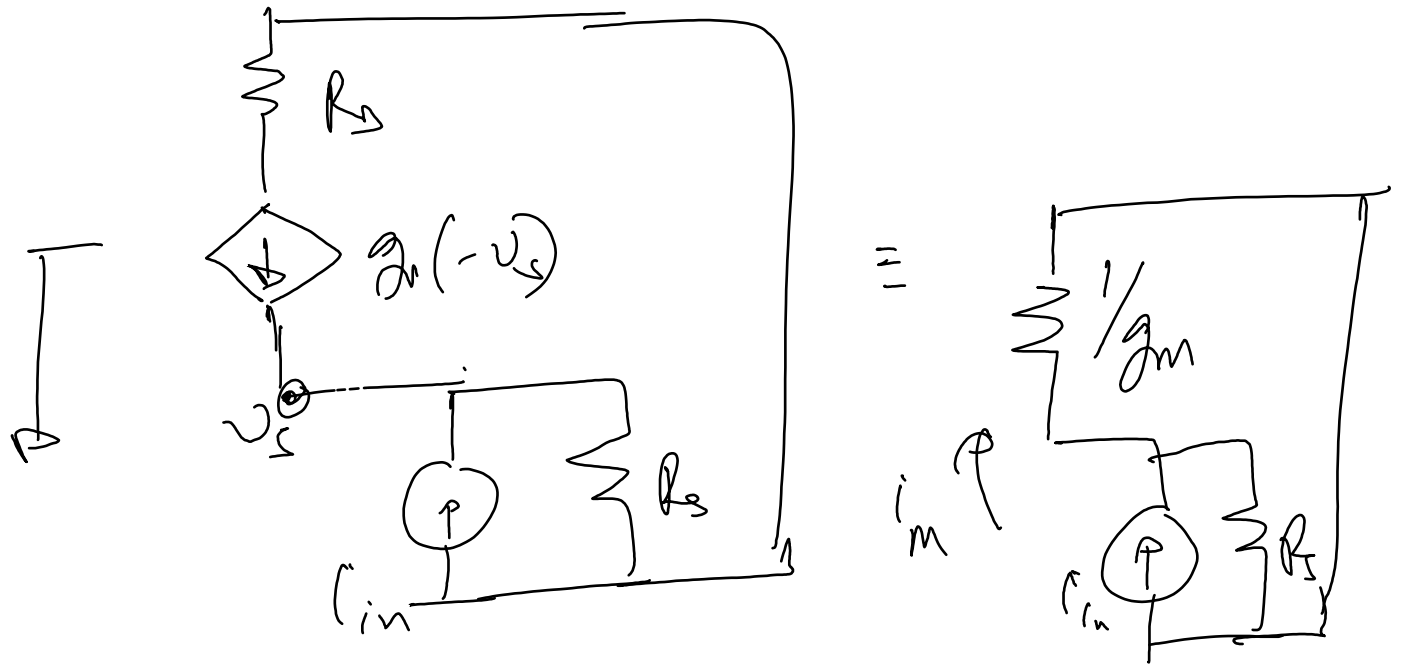
a) : Find the maximum R_L that can while keeping the transistor in saturation under quiescent condition. **[2]**

$$V_{OS} = V_{DD} - I_{DC} R_L \geq V_B - V_{tn}$$

$$\Rightarrow R_L \leq \frac{V_{DD} - V_B + V_{tn}}{I_{DC}}$$

$$= 3k\Omega$$

b) : Assume $i_{in} = I_p \sin(\omega_0 t)$, $R_s = 10k\Omega$ and C acts as a short circuit at ω_0. What fraction of the i_{in} flows into the transistor? Is the element inside the box more suited to accept a current input or a voltage input? Assume that the current source has an internal resistance of more than $10k\Omega$ (in parallel) **[4 + 2]**



$$i_M = i_{in} \frac{R_s}{R_s + 1/g_m} \Rightarrow \frac{i_M}{i_{in}} = \frac{10k}{10k + 0.5k}$$

$\therefore$ $R_{in} = 1/g_m \ll R_s$ $\therefore$ Suitable for accepting curr

c) : If i_{in} is a step input, with what time-constant will the voltage at V_0 settle to its final value? **[2]**

$$\tau = C\left(R_s + 1/g_m\right)$$