

EE210: Analog Electronics - Quiz 1

NAME (in capital)

Roll No

Time: 15 minutes

1) : In the figure shown below a voltage controlled current source (modeled in (b)) is being used network.

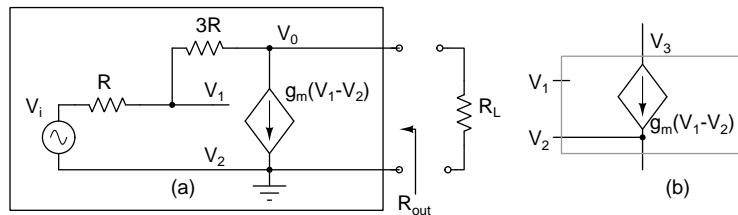
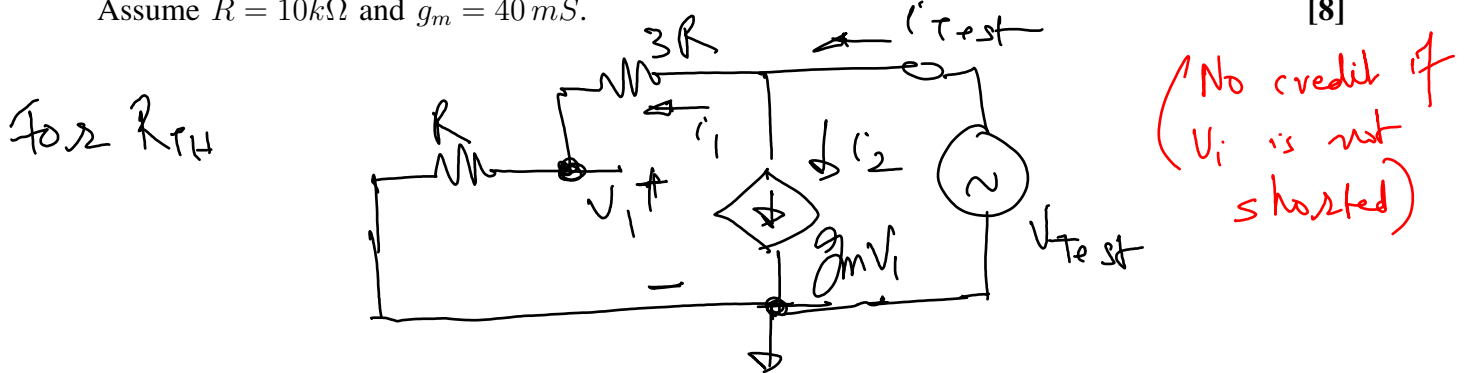


Fig. 1. Problem 1

a) : Sketch the Thevenin's equivalent network (without R_L) and mark the component values. Assume $R = 10k\Omega$ and $g_m = 40 mS$. [8]



$$V_1 = \frac{V_{Test}}{4}$$

$$i_1 = \frac{V_{Test}}{4R}$$

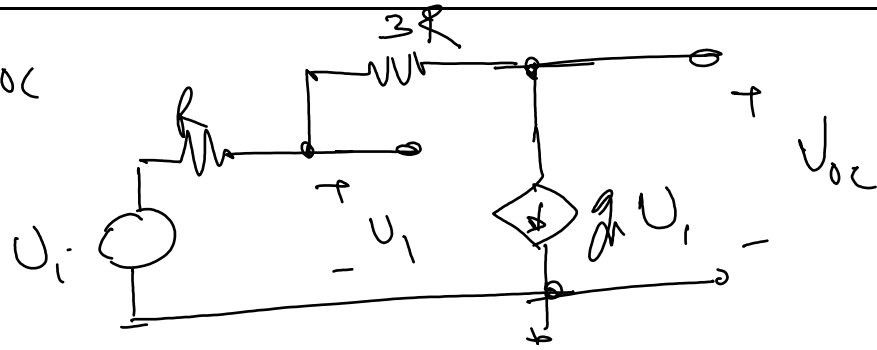
$$i_2 = g_m V_1 = g_m \frac{V_{Test}}{4}$$

$$i_{Test} = V_{Test} \left(\frac{1}{4R} + \frac{g_m}{4} \right)$$

$$\Rightarrow \frac{V_{Test}}{i_{Test}} = \frac{1}{\frac{1}{4R} + \frac{g_m}{4}} = \frac{1}{\frac{1}{40} m + 10m} \approx 100 \Omega$$

$$\Rightarrow R_{TH} = 100 \Omega$$

contd..

for V_{oc} 

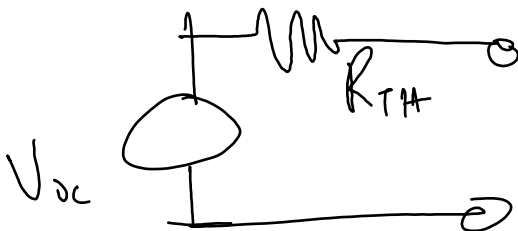
$$V_1 = \frac{V_{oc} R + V_i 3R}{4R} = \frac{V_{oc} + 3V_i}{4}$$

$$KCL @ V_{oc} \equiv \frac{V_i - V_{oc}}{R} = g_m \frac{V_{oc} + 3V_i}{4}$$

$$\Rightarrow V_i - V_{oc} = (g_m R) (V_{oc} + 3V_i)$$

$$\Rightarrow 401 V_{oc} = -1199 V_i$$

$$\Rightarrow \boxed{V_{oc} \approx -3V_i}$$



Thevenin's Equivalent.

b) : If R_L is connected across the output terminal of (a), will the network behave more like a voltage or a current source given that $1k\Omega < R_L < 10k\Omega$. Justify your answer. [2]

$$\because R_L \gg R_{TH} \quad \therefore \text{No loading effect}$$

\Rightarrow Network works like a voltage source.