

EE210: Analog Electronics - Quiz 2

NAME (in capital)

Roll No

Time: 15 minutes

1) : Consider the circuit in Fig. 1(a). $R_1 = 2k\Omega$. The $I - V$ characteristic of the non-linear element E is shown in Fig. 1(b).

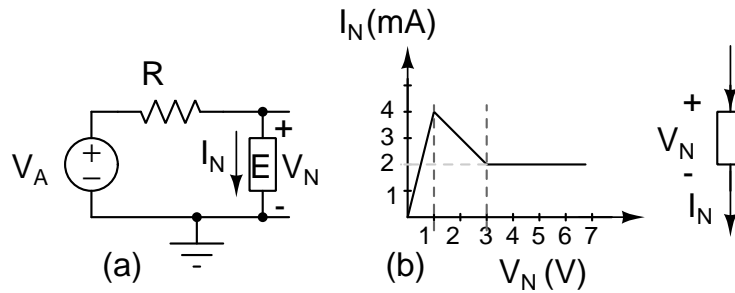


Fig. 1. Problem 1

a) : Find V_A such that $V_N = 2V$. Let us call this value V_{AQ} .

[4]

$$V_N = 2V \Rightarrow I_N = 3mA \text{ and slope} = -1mA/V$$

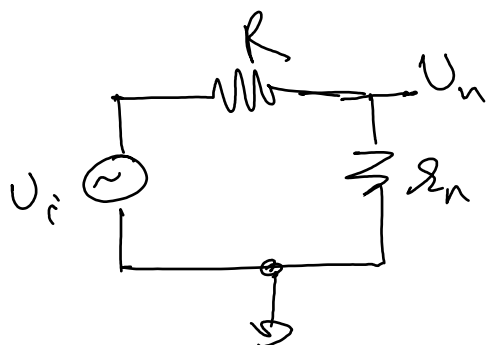
(From the plot)

$$KCL @ V_N \Rightarrow \frac{V_A - V_N}{R} = I_N$$

$$\Rightarrow V_A = V_N + I_N R$$

$$= 2 + 6 \Rightarrow V_A = 8V$$

b) : If $V_A = V_{AQ} + 10\text{mV} \sin(\omega t)$, sketch the incremental network and find the total v_N . [4]



$$U_i = 10\text{mV} \sin(\omega t)$$

$$g_m = \frac{-1}{\left(\frac{\partial I_N}{\partial V_N}\right)}_{V_N=2\text{V}} = -1\text{k}\Omega$$

$$\therefore v_n = \frac{g_m}{R + g_m} U_i = -10\text{mV} \sin(\omega t)$$

$$\therefore V_N = 2\text{V} - 10\text{mV} \sin(\omega t)$$

c) : Is there any V_N for which the incremental change in input voltage not lead to any change in the output voltage? [2]

For this to happen g_m must be 0
 \Rightarrow slope of ∞ in the $I-V$ char of
 the non-lin element.

\therefore No such V_N exists.