# EE210: Analog Electronics - Quiz 2

NAME (in capital)                                         Roll No

Time: 15 minutes

*1)* : Consider the circuit in Fig. 1(a). $R1 = 2k\Omega$. The $I - V$ characteristic of the non-linear element $E$ is shown in Fig. 1(b).
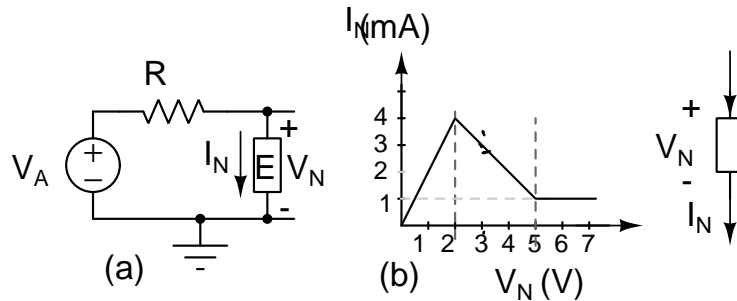


Fig. 1.  Problem 1

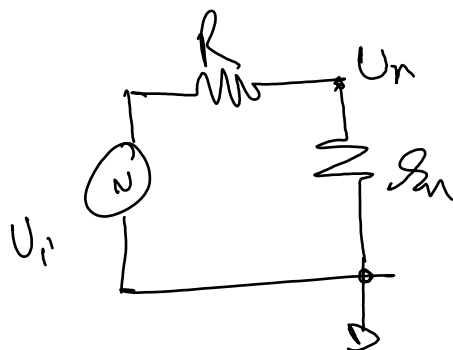*a)* : Find $V_A$ such that $V_N = 3V$. Let us call this value $V_{AQ}$.                **[4]**

$$V_N = 3V \implies I_N = 3mA \quad \left(\text{from the plot}\right).$$

$$\therefore \text{KCL @ } V_N \implies \frac{V_A - V_N}{R} = I_N$$

$$\implies V_A = 3 + 6 = 9V$$

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

**[4]**

$$r_n = \frac{1}{\left(\frac{\partial i_N}{\partial v_N}\right)_{V_N}} = -1 k\Omega$$

$$\therefore \quad v_n = \frac{U_i \; r_n}{R + r_n} = -10mV \sin(\omega_0 t)$$

$$\therefore \quad v_N = 3V - 10mV \sin(\omega_0 t)$$

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

**[2]**

No $\therefore r_n = 0$ zone implies infinite slope

in the $\underline{i} - v$ char of $F$, this is not possible.