EE210: Analog Electronics

Question Set 3

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1) : Sketch the two port incremental Y-Parameter for the network shown in the figure with the following I-V characteristics.

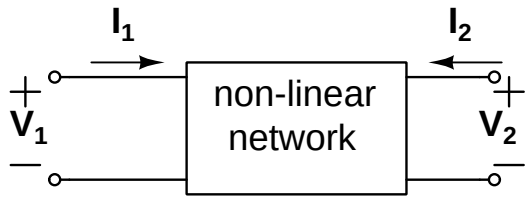

Fig. 1. Problem 1

a) : $I_1 = 0$ for all V_1, V_2.

$$I_2 = \begin{cases} \beta V_1^2 & \text{when } V_1 \geq 0 \\ 0 & \text{otherwise.} \end{cases}$$

b) : $I_1 = 0$ for all V_1, V_2.

$$I_2 = \begin{cases} \beta(V_1 - V_{th})^2 & \text{when } V_1 \geq V_{th} \\ 0 & \text{otherwise.} \end{cases}$$

c) : $I_1 = 0$ for all V_1, V_2.

$$I_2 = \begin{cases} \beta(V_1 - V_{th})^2(1+\lambda V_2) & \text{when } V_1 \geq V_{th} \\ 0 & \text{otherwise.} \end{cases}$$

d) : $I_1 = I_2/(\beta)$ for all V_1, V_2.
$I_2 = I_o e^{v_1/v_T}$ for all V_1, V_2.

2) : Find v_o/v_i if the incremental two port network has Y-Parameters corresponding to Q1 (a-d)

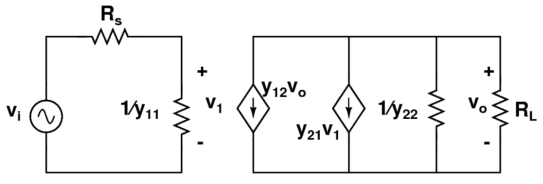

Fig. 2. Problem 2

3) : Find the following

a) : Find v_o/v_i.

b) : Find v_o/v_i when $y_{21} \to \infty$.

c) : Find v_o/v_i when $R_L \to \infty$.

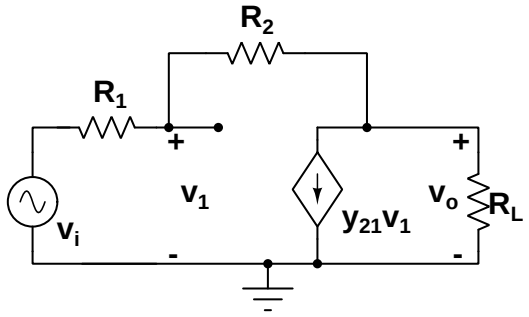

Fig. 3. Problem 3

4) : I-V characteristic of the two port network is as follows
$I_1 = 0$ for all V_1, V_2.

$$I_2 = \begin{cases} \beta V_1^2 & \text{when } V_1 > 0 \text{ and } V_2 > 0 \\ \text{in-valid} & \text{otherwise.} \end{cases}$$

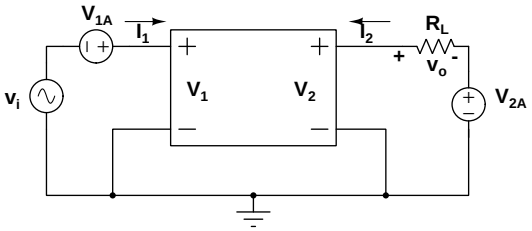

Fig. 4. Problem 4

a) : Sketch the small signal network. Assume $V_{1A} = 1V, V_{2A} = 5V, \beta = 1mA/V^2, R_L = 2k\Omega$.

b) : Find the small signal gain v_o/v_i.

c) : Will the small signal parameter will change if $V_{2A} = 1V$?.

d) : A designer wants to achieve a voltage gain of $|v_o/v_i|$=10 using $R_L = 2k\Omega$. Suggest a solution which helps her achieve the goal.You are free to change V_{1A} and V_{2A}.