ECE 580 Network Theory, Fall 2016

Test Date: 10/31/2016

Problems: 3

Total Pages: 6

Name: _____

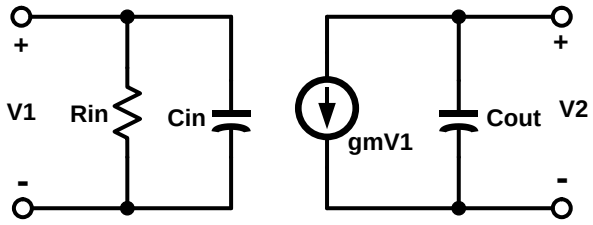
Secret Code (5 Digit): _____

1. **(15 points) _____**
2. **(15 points) _____**
3. **(5 points) _____**

Total (35 points) _____

Good Luck

Problem 1: (15 points) Estimate the H parameters for the circuit shown below.



$$V_1 = h_{11} I_1 + h_{12} V_2$$
$$I_2 = h_{21} I_1 + h_{22} V_2$$

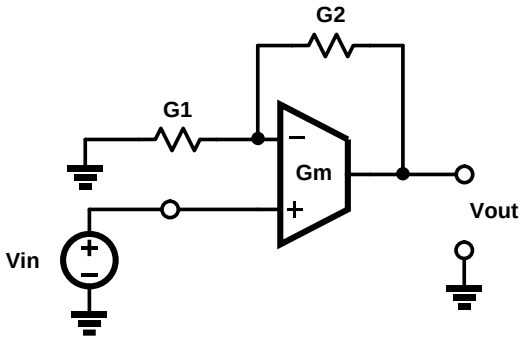
$$h_{11} = \frac{R_{in}}{1 + s R_{in} C_{in}}$$

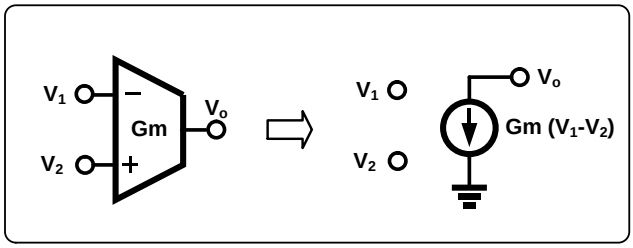
$$h_{21} = \frac{g_m R_{in}}{1 + s C_{in} R_{in}}$$

$$h_{12} = 0$$

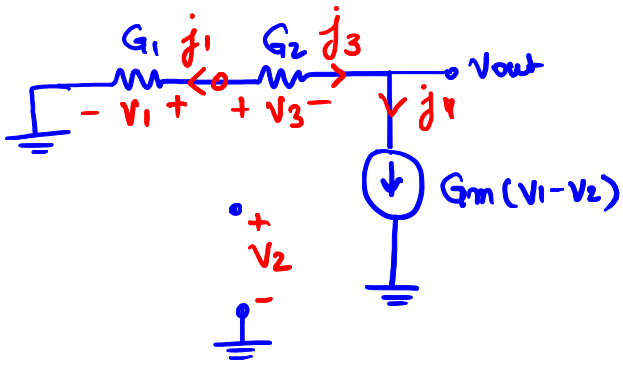
$$h_{22} = s C_{out}$$

Problem 2: (15 points) Calculate the sensitivity of Vout to network parameters: G1 and G2 using the adjoint network concept.



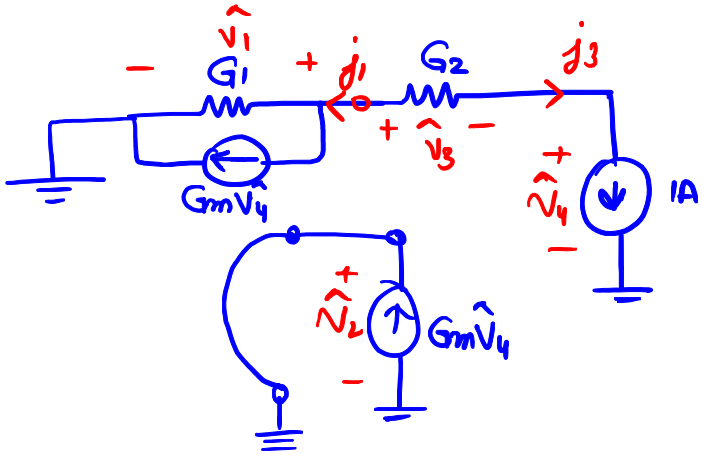


Network N:



$$G = \begin{bmatrix} G_1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & G_2 & 0 \\ Gm & -Gm & 0 & 0 \end{bmatrix} \quad ; \quad \hat{G} = G^T$$

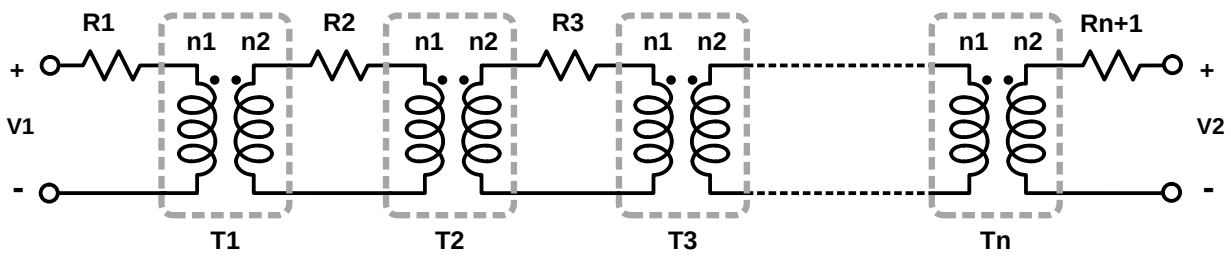
Network $\hat{N}$:



$$\frac{\partial V_{out}}{\partial G_1} = \hat{V}_1 V_1 = \frac{V_{in} G_m (G_m - G_2)}{G_2 (G_m + G_1)^2}$$

$$\frac{\partial V_{out}}{\partial G_2} = \hat{V}_3 V_3 = -\frac{V_{in} G_m G_1}{G_2^2 (G_m + G_1)}$$

Problem 3: (5 points) Calculate Y_{11} for the network shown below:



For Y_{11} Set $V_2 = 0$

$$Y_{11} = \frac{1}{R_1 + \left(\frac{n_1}{n_2}\right)^2\left(R_2 + \left(\frac{n_1}{n_2}\right)^2\left(R_3 + \cdots \left(\frac{n_1}{n_2}\right)^2\left(R_n + \left(\frac{n_1}{n_2}\right)^2 R_{n+1}\right)\right)\right)}$$

$$Y_{11} = \frac{1}{R_1 + \left(\frac{n_1}{n_2}\right)^2 R_2 + \left(\frac{n_1}{n_2}\right)^4 R_3 + \cdots \left(\frac{n_1}{n_2}\right)^{2n} R_{n+1}}$$

Supplementary page: