1 June 2024

Circuit and System Analysis
Final Exam

1. For the circuit in Figure 1, $R_1 = 1\Omega$, $R_2 = 1\Omega$, $C = 1F$, $L = 1H$, $v_k(t) = \cos(t)$ and $i_3 = v_1$ are given. (a) Obtain Y_1 and Y_2 admintans. (b) Find the Thévenin equivalent circuit (in sinusoidal steady-state) with respect to the terminals a and b. (c) Calculate the load impedance to connect the terminal between a and b for maximum average power transfer. (d) Calculate the complex power and $cos\phi$ of the independent voltage source (v_k) in the case of (c).

2. For the circuit given in Figure 2, (a) Express $V_o(s)$ in terms of $V_s(s)$, R, C and the initial condition $v_C(0)$ in the Laplace domain. (b) Obtain the transfer function $H(s) = \frac{V_o}{V_s}$.

3. The circuit which is given in Figure 3 with $v_3 = ri_1$ and $i_4 = gv_2$, is in sinusoidal steady-state. Obtain modified (generalized) mesh equation to analyze the circuit.

4. Find the y-parameters for the 2-port network shown in Figure 4 with $v_3 = \alpha i_a$. Not that $I_1 = y_{1,1}V_1 + y_{1,2}V_2$ and $I_2 = y_{2,1}V_1 + y_{2,2}V_2$.

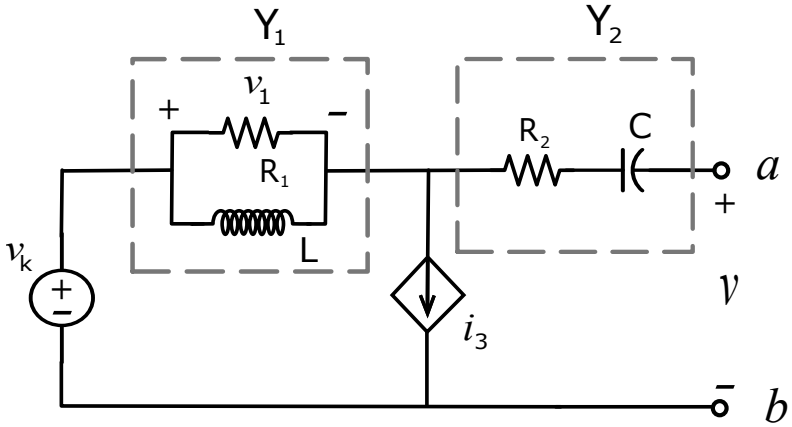

Figure 1

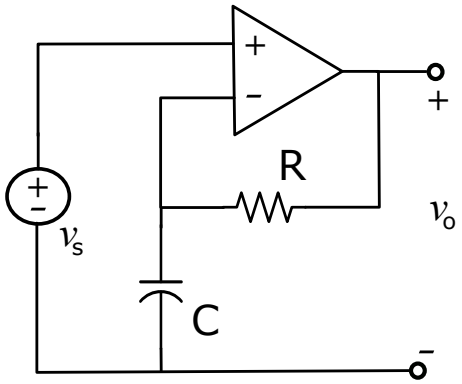

Figure 2

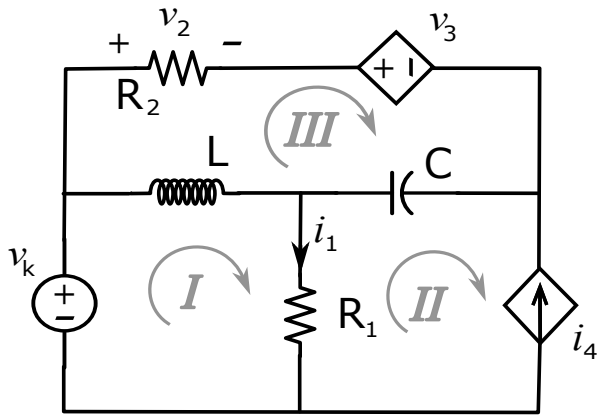

Figure 3

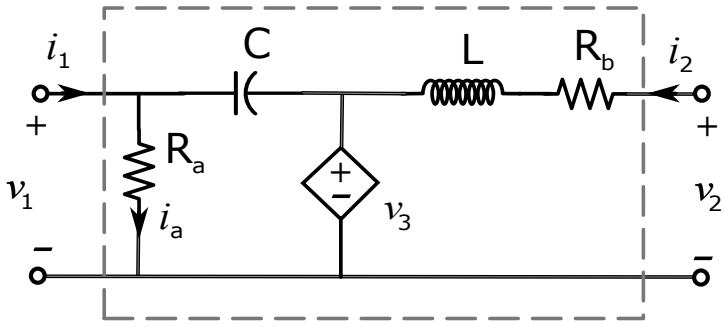

Figure 4

At the end of the exam, please hand in this sheet, along with your answers.

Good luck !