EE240: Circuits I

ASSIGNMENT 3

Due Date: 29 Oct 2019

- Submissions will only be accepted on A4 sized papers.
- Write your name and roll number clearly at the top of the assignment.
- You are required to show working where necessary; answers will not be graded if working is not shown.
- The assignment is worth **100** marks, you are advised to start early as it is long.
- Feel free to contact the instructor or teaching assistants if you have any questions.
- Any instance of plagiarism will be **severely** dealt with; such cases would be subjected to **disciplinary action** in accordance with university rules and regulations.

Problem 1 (5 marks)

Calculate V_0 , given that the following networks are equivalent at the given terminals.

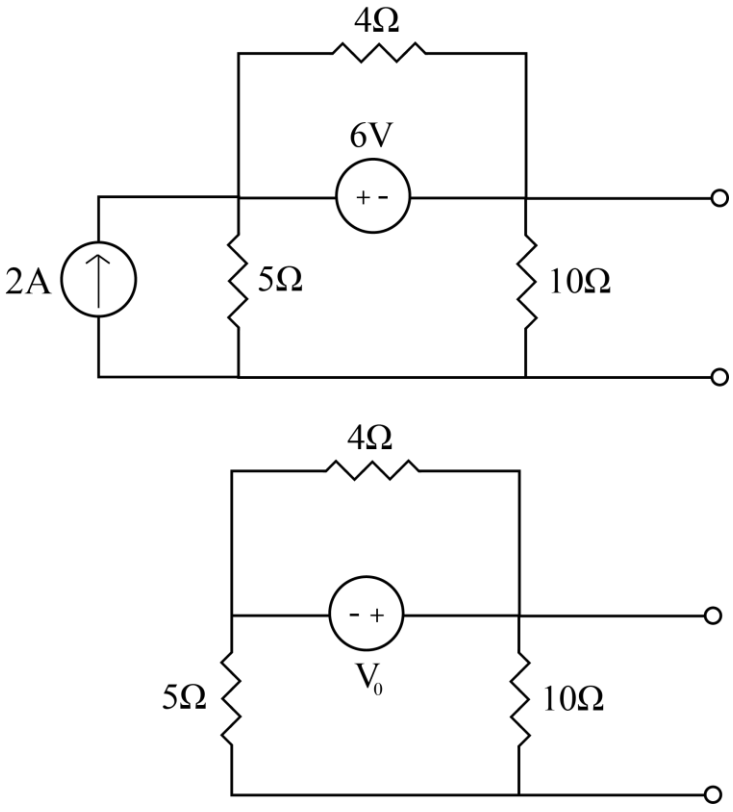

Figure 1

Problem 2 (13 marks)

Draw the dual networks of the following circuits (take care of the units).

(a) [**5 marks**]

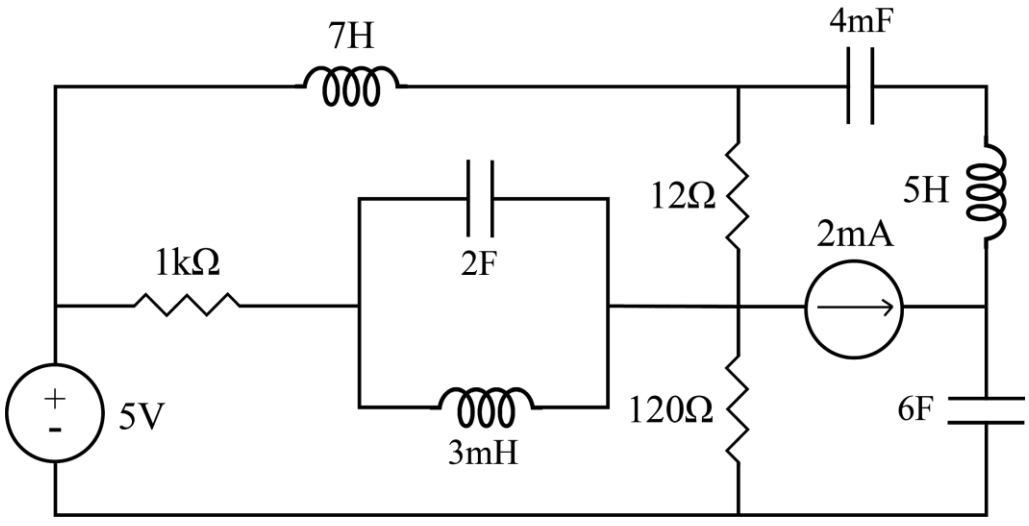

Figure 2

(b) [**8 marks**]

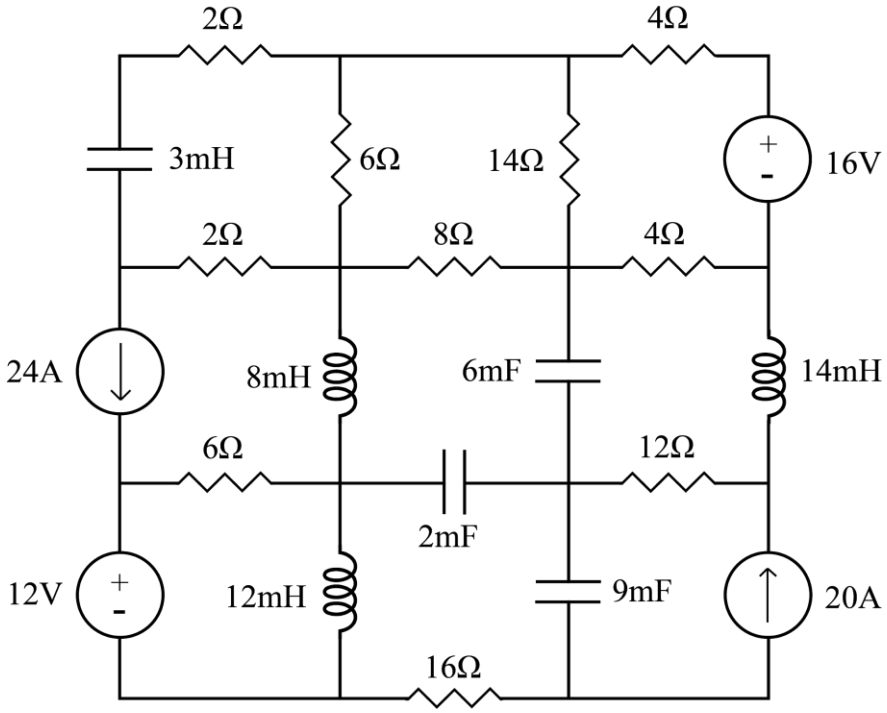

Figure 3

Problem 3 (15 marks)

Calculate i_o for the following circuit by finding the Norton equivalent circuit. Show all the steps.

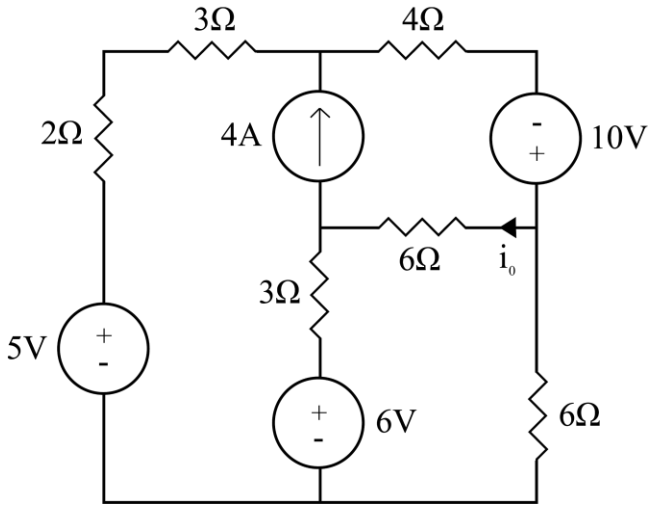

Figure 4

Problem 4 (12 marks)

(a) [**10 marks**] Find the value of $\mathbf{R_L}$ such that maximum power is transferred from the circuit to the resistor.

(b) [**2 marks**] Calculate the maximum power that can be transferred to this resistor.

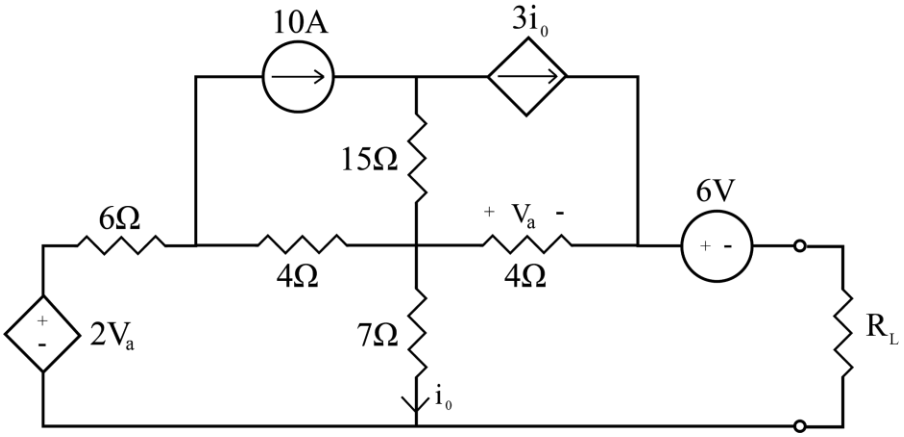

Figure 5

Problem 5 (10 marks)

Find $\mathbf{R_{th}}$ across the terminals shown in the figure below.

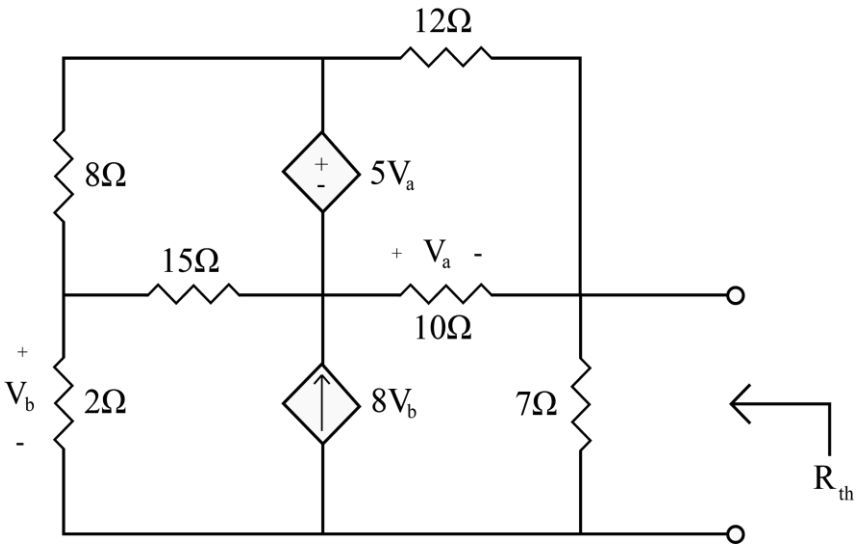

Figure 6

Problem 6 (10 marks)

You are given the circuit depicted below in *Figure 7.*

(a) [**6 marks**] Clearly identify and label all nodes on the circuit. Then, apply nodal analysis to derive the complete set of nodal equations.

(b) [**4 marks**] Calculate all nodal voltages and determine $\mathbf{V_x}$. You may use a digital Gaussian elimination calculator.

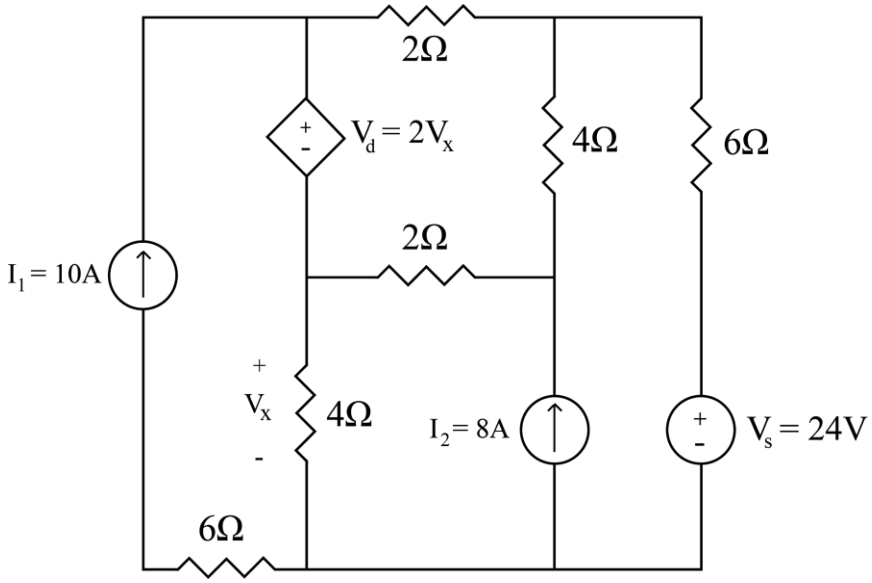

Figure 7

Problem 7 (15 marks)

The circuit given below is a complex network of resistors powered by both independent and dependent voltage and current sources. Apply nodal analysis to derive the complete set of nodal equations. Then, determine all nodal voltages as well as $\mathbf{V_x}$, $\mathbf{V_y}$, and $\mathbf{V_z}$ across the three resistors shown in the circuit.

Note: You will first need to simplify the resistor combinations within the circuit.

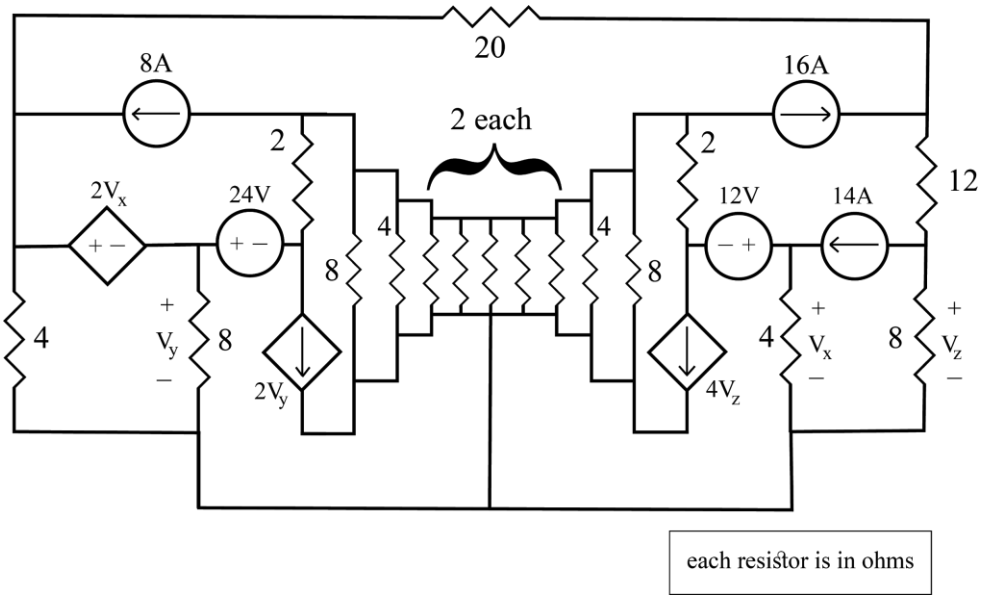

Figure 8

Problem 8 (20 marks)

For the circuit given below, derive the complete set of loop equations and calculate all loop currents. Clearly label all loops. It is recommended that you simplify the circuit first by applying source transformation where applicable.

Note: All loop currents should be taken in the clockwise direction.

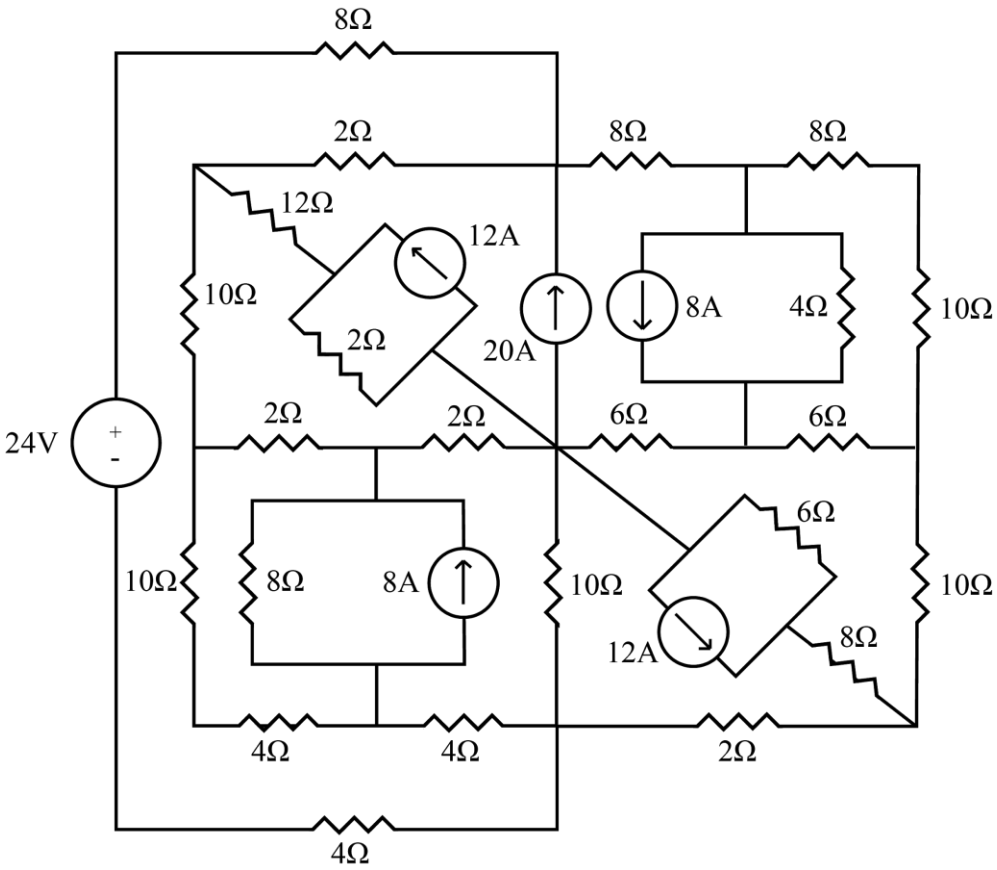

Figure 9