EE240: Circuits I

ASSIGNMENT 2

Due Date: 08 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 the university rules and regulations.

Course Learning Outcomes Covered:

CLO2: Demonstrate the understanding and use of component and network conventions and network topology

Problem 1 (15 marks)

(a) [**7 marks**] Find i_0 using source transformation.

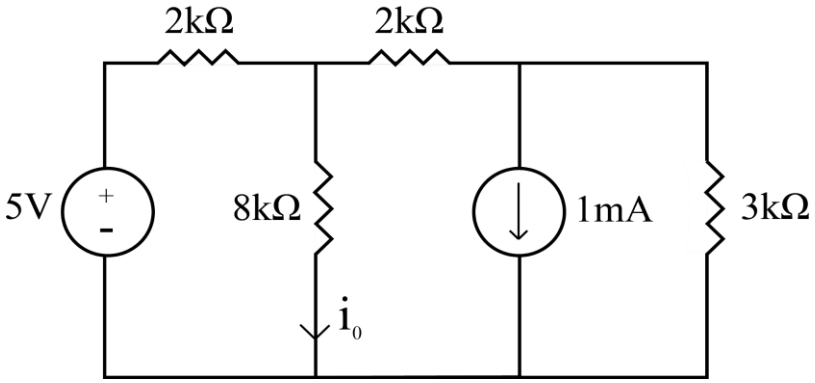

Figure 1

(b) [**7 marks**] Find i_0 in the circuit given below using source transformation. Keep in mind the polarities of the sources.

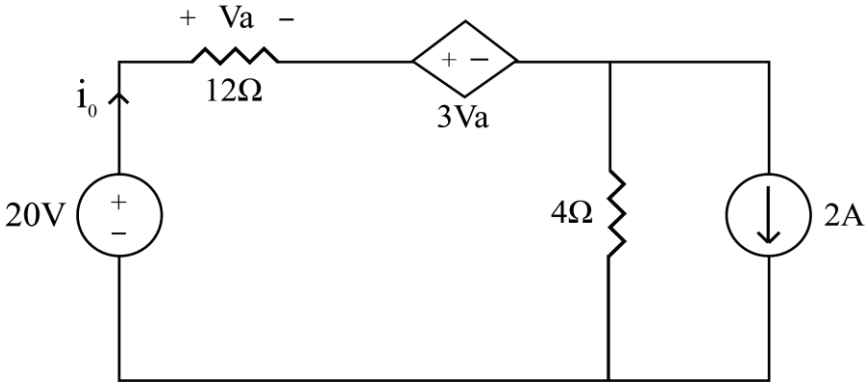

Figure 2

Problem 2 (15 marks)

(a) [**10 marks**] Calculate v_0 using superposition theorem:

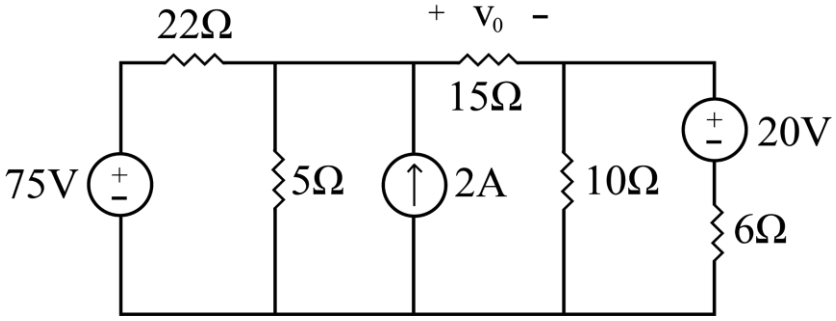

Figure 3

(b) [**5 marks**] Find i_0 in the circuit below using superposition. Hint: you may find it useful to apply source transformation as well.

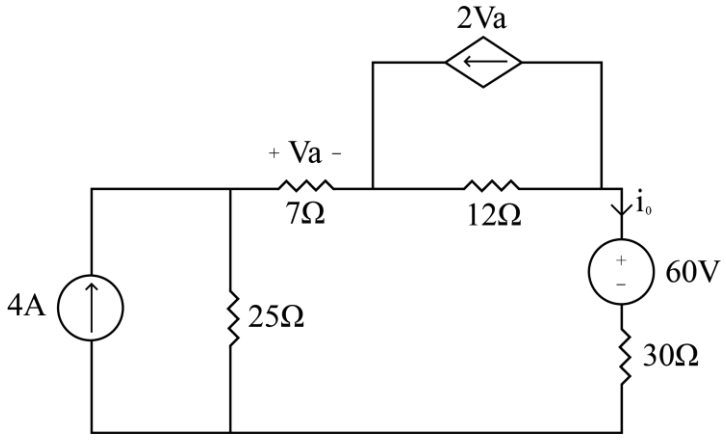

Figure 4

Problem 3 (10 marks)

Establish polarity markings on the following coils on a magnetic flux-conducting core using symbols. Provide a key with your solution.

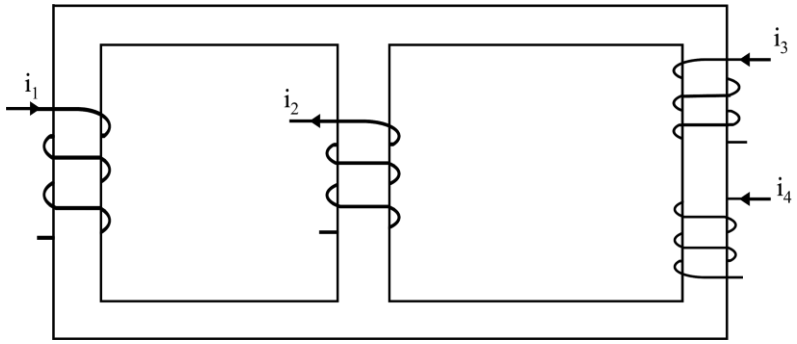

Figure 5

Problem 4 (10 marks)

The following figure shows a coil around a magnetic flux-conducting core and three other currents. Using the given symbols and key, draw the remaining windings in appropriate directions.

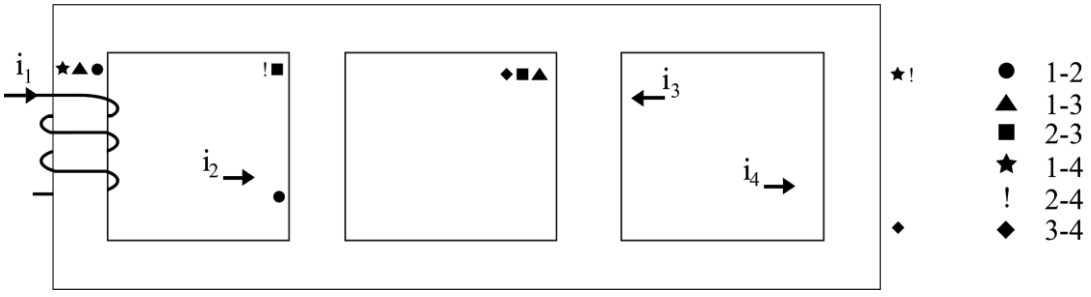

Figure 6

Problem 5 (5 marks)

Calculate v_0 for the circuit given below:

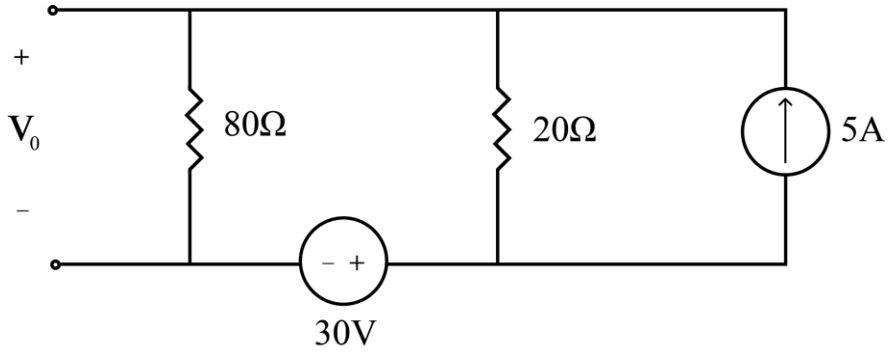

Figure 7

Problem 6 (20 marks)

For the circuit given below *(Figure 8)* with the stipulated mutual inductances, apply Mesh Analysis to produce the complete set of loop equations. You may define your own loops and corresponding loop currents. Be sure to adhere to dot convention. Note: All loops should be defined in the clockwise direction.

Mutual Inductances:

L_1 & L_3 = M_a

L_1 & L_5 = M_b

L_2 & L_4 = M_c

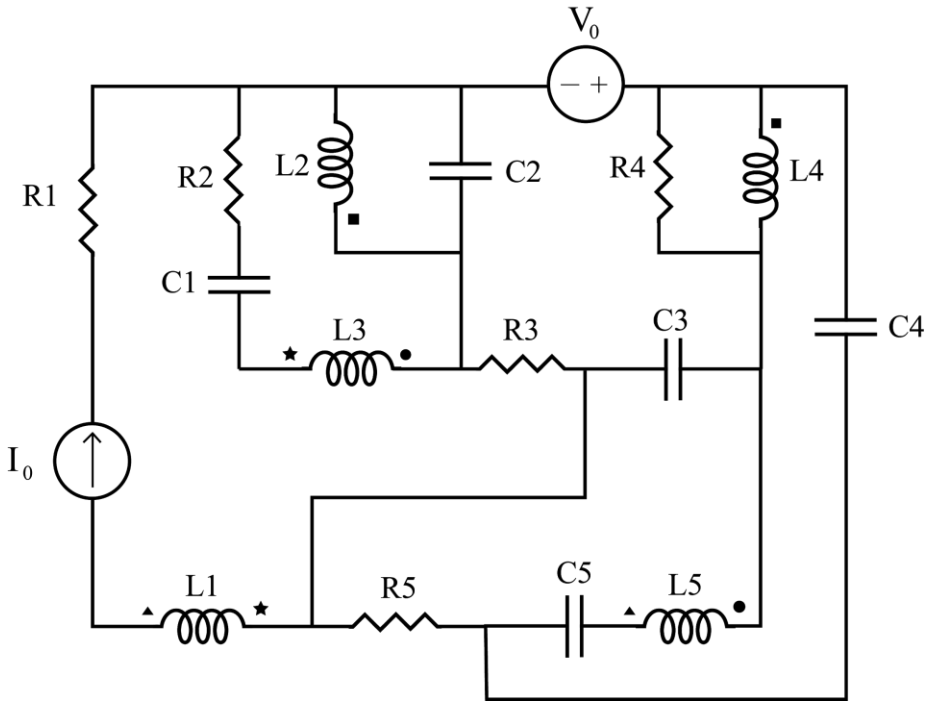

Figure 8

Problem 7 (10 marks)

Refer to the circuit given in the previous question *(Figure 8)*.

(a) [**3 marks**] Identify the number of nodes in the circuit and label them on the diagram.

(b) [**1 mark**] Determine the number of nodal equations that this circuit will yield.

(c) [**1 mark**] Calculate the number of branches in this circuit.

(d) [**3 marks**] Draw the graph of the circuit.

(e) [**2 marks**] Draw a tree of the circuit.

Problem 8 (15 marks)

For the circuit given below *(Figure 9)*, apply Kirchhoff's Current Law (KCL) to produce the complete set of nodal equations.

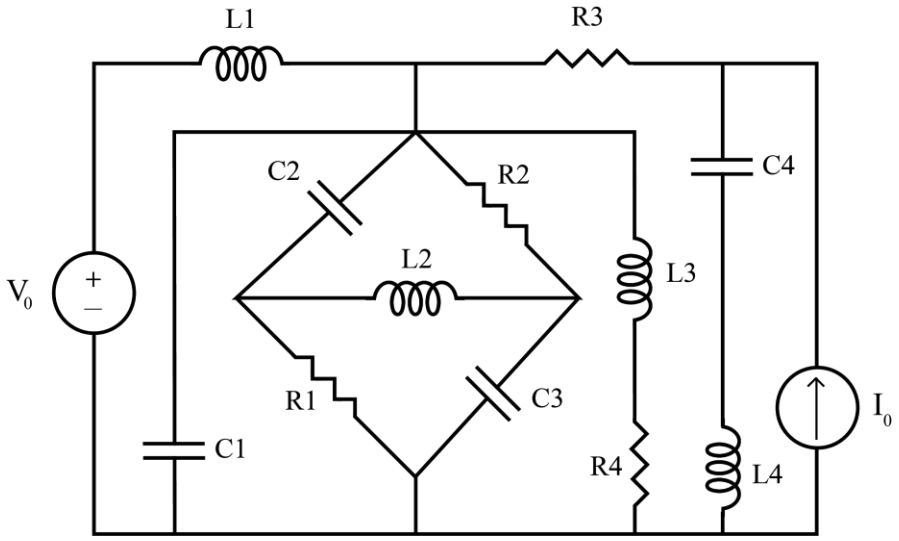

Figure 9