LUMS
A Not-for-Profit University

Department of Electrical Engineering
School of Science and Engineering

EE240 Circuits I - Fall 2022

ASSIGNMENT 2

Due Date: Wednesday, October 19, 2022 (Submit in class)
Format: 6 problems, for a total of 75 marks

Instructions:

- Solve the assignment on blank A4 sheets and submit the solved assignment during the class.
- Naming convention should be as follows: "Name_RollNumber_Assignment_2.pdf"
- Feel free to contact the instructor or the teaching assistants if you have any concerns.

- You represent the most competent individuals in the country, do not let plagiarism come in between your learning. In case any instance of plagiarism is detected, the disciplinary case will be dealt with according to the university's rules and regulations.

Course Learning Outcomes Covered:

Derive and apply working principle of passive components R, L,C and independent and controlled energy sources for device and circuit modeling and analysis

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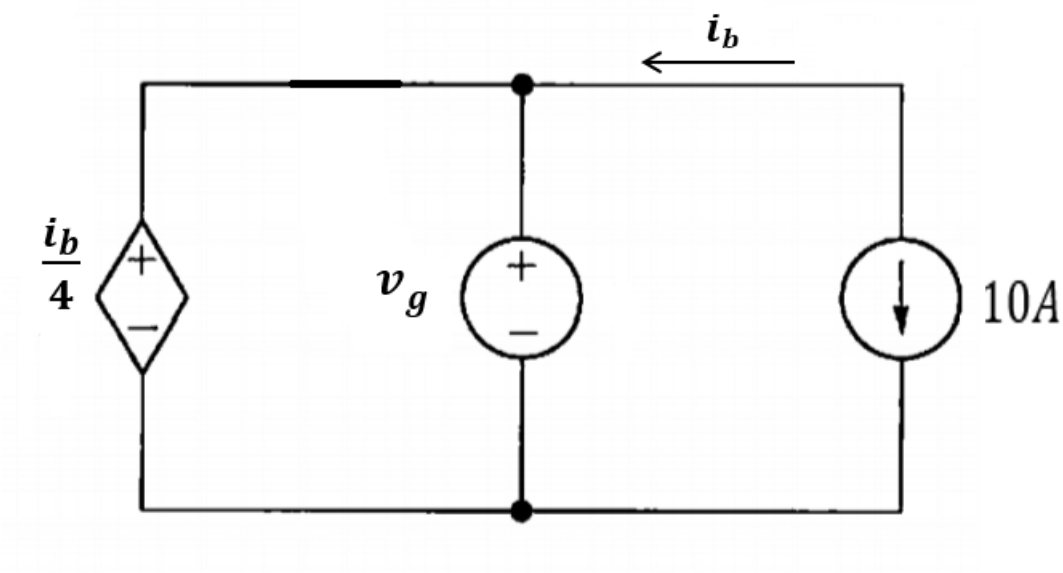
Q1) (5 marks)

Consider the circuit below and answer the following questions:

a) What value of v_g is required for the interconnection to be valid.

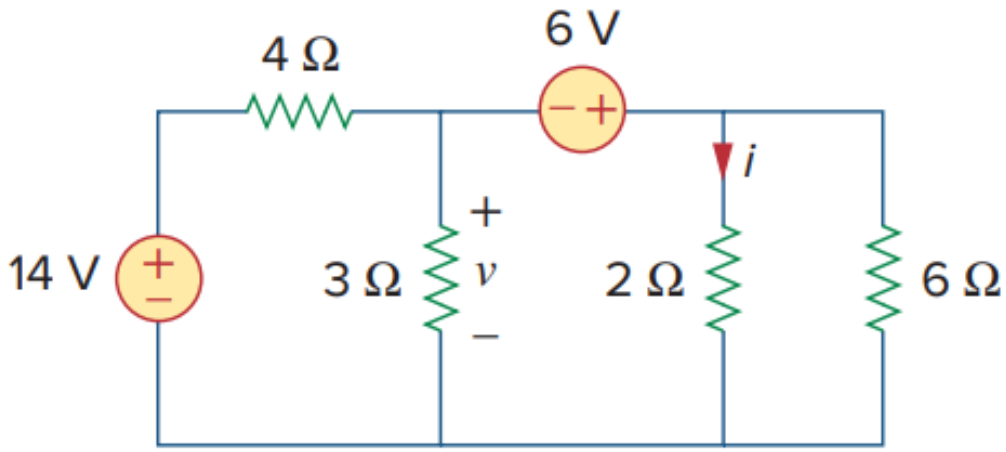
b) For this value of v_g find the power associated with the 10A source.



Q2) (10 marks)

Given this circuit below, find the values of i by using source transformation:

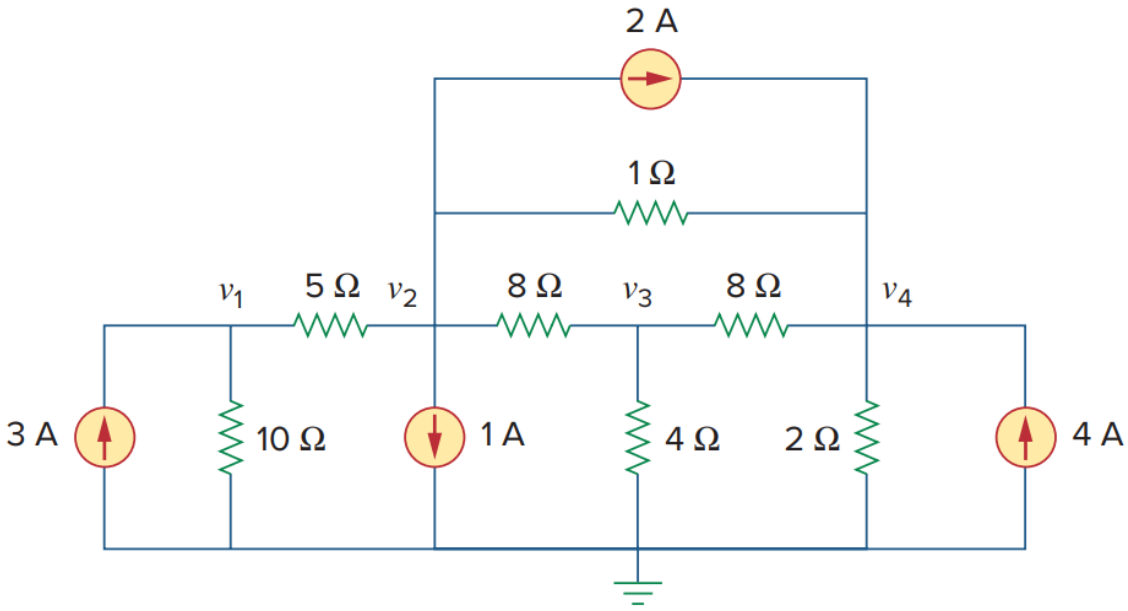
(Hint: Use Kirchoff voltage law to find the currents flowing in the loop first)



Q3) (15 marks)

Consider this circuit and answer the following parts:

a) Formulate network equations
b) Convert it into matrix form and then solve for the nodal voltages



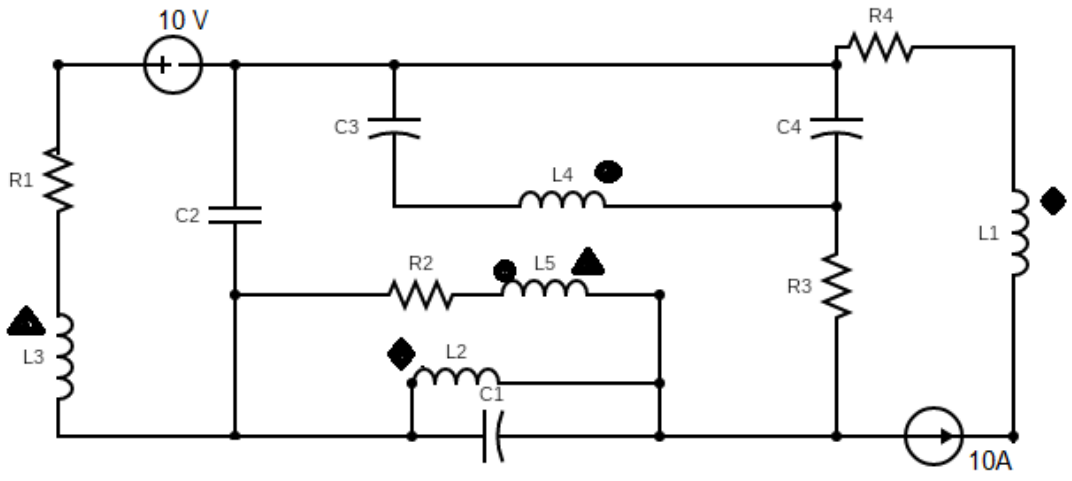
Q4) (20 marks)

Consider the circuit drawn below. Formulate the loop equations by considering the current in each loop in anticlockwise direction. You must make use of the dot convention while considering the mutual inductances which are given below:

$$\boldsymbol{L1\ and\ L2 = Ma}$$

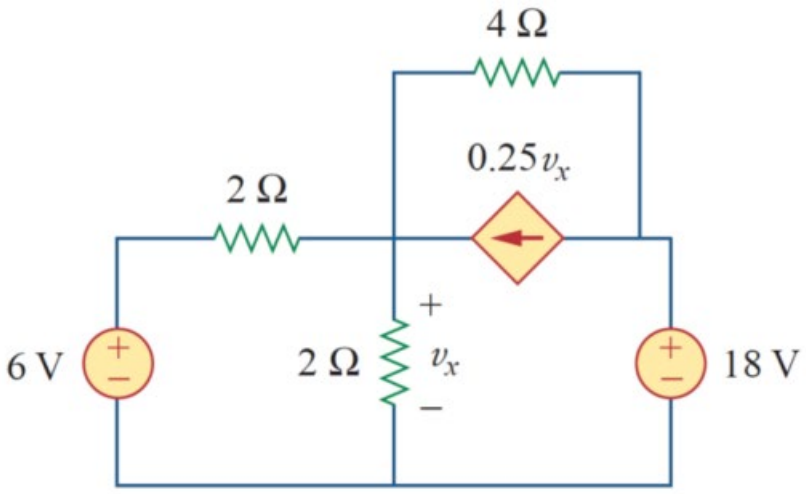
$$\boldsymbol{L3\ and\ L5 = Mb}$$

$$\boldsymbol{L4\ and\ L5 = Mc}$$



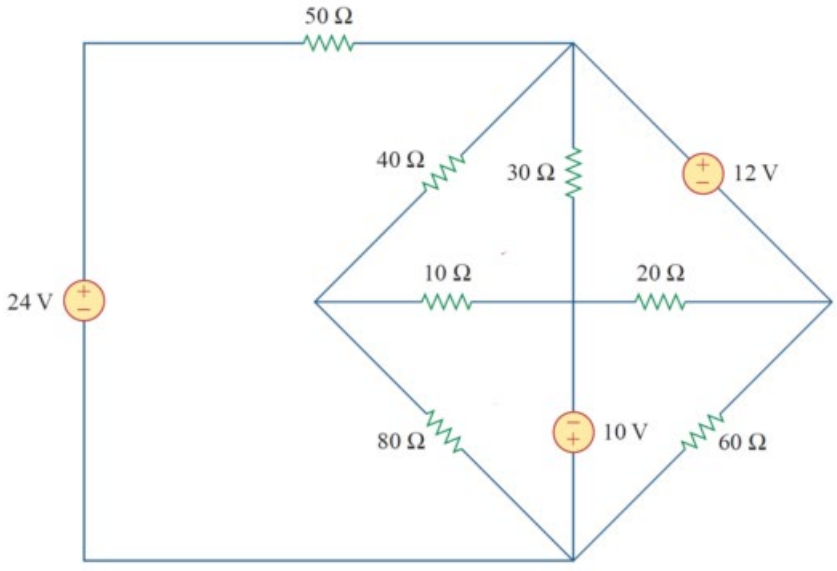
Q5) (10 marks)

Determine the voltage v_x in the following circuit using the source transformation technique.



Q6) (20 marks)

Consider the circuit given below and answer the following parts:



a) Draw the graph and one tree of the circuit. Determine the number of nodes and number of branches in the circuit (or graph).

b) Determine the number of network equations required for carrying out
   i) nodal analysis
   ii) loop analysis.

c) Carry out the loop analysis, that is, identify and determine the loop currents.