Module Code	Examiner	Department	Ext
EEE 103	T.O. Ting	Electrical & Electronic Engineering	1416

Xi'an Jiaotong-Liverpool University
西交利物浦大學

2020/21 Semester 1 - Assignment(Final)

Bachelor Degree - Year 2

Electrical Circuit 1

Time Allowed : 7 Days

Instructions to Candidates

1. There are four questions in this assignment. The mark allocated for each question is on the right column of the relevant page.
2. The final numerical answers should be stated in two significant figures. Please highlight your final answer by marking it with the symbol #.
3. Please be reminded that correct answers do not guarantee full marks: mark penalty will be imposed for missing intermediate steps, illogical process, missing relevant illustration, poor presentation, erroneous notation, and missing unit.
4. The pdf version of cover page with square papers will be provided for your answers. Any similar hardcopy version of the square paper is acceptable.
5. Scan and upload your written solution onto the Learning Mall before the specified deadline.
6. Please be advised that you are free to discuss the questions among your classmates. However, please write the solutions all by yourself; any identical parts found will be penalized according to the university's policy on plagiarism.

Question 1 (30 marks)

Referring to the network in the Figure 1 below,

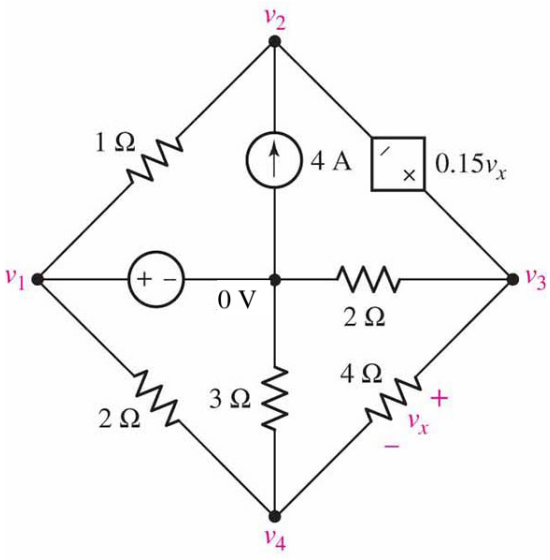

Figure 1: Circuit for question 1

(a) Apply node analysis to all unknown nodes in Figure 1. Based on this analysis, specify all the equations that you have obtained. [20]

(b) Based on the equations obtained above, is there any possible solution? State the reason for your answer. If the solution is impossible, suggest a simple addition or change to the network above, and prove that your suggestion is valid. [10]

Question 2 (20 marks)

Assuming the 2 Ω resistor as a load, find the Thevenin-equivalent-circuit across terminals v_1 and v_4 in Figure 2 below. Draw the relevant TEC diagram.

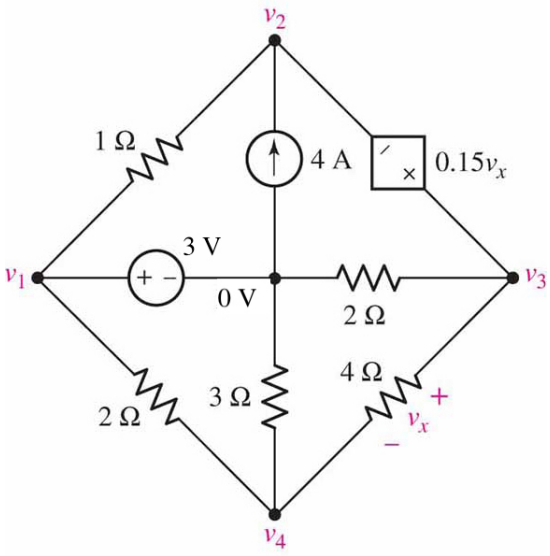

Figure 2: Circuit for question 2

Question 3 (30 marks)

Consider an approximate model of the epitaxial resistivity in a silicon power transistor: A pyramid structure with a square base has a resistor in every edge of the structure. The structure of the model is shown in Figure 3 below.

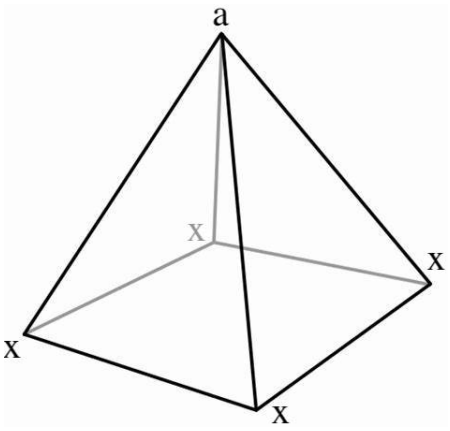

Figure 3: Structure diagram for question 3

(a) Based on the description above, draw the relevant structure and include relevant resistors in your diagram. [5]

(b) Suppose the value of all resistors is R Ω, calculate the total resistance viewing from any of the a-x pairs. [15]

(c) Is the total resistance similar for all possible vertex pairs? Verify your statement above by including relevant calculation proof. [10]

Question 4 (20 marks)

Consider the following power system model with the following entities:

i. A generator generates a sinusoidal waveform with amplitude of 300 V and angular frequency of 5 radians,

ii. The transmission line has a resistance of 1 Ω, and

iii. A capacitive load with a value of 2F presents at the end of the system.

Answer the following questions:

(a) Draw the relevant diagram and label all entity values of the power system as described above. [5]

(b) Replacing the real source in Figure 4(a) with a complex source, find the response of the steady-state capacitor voltage in time-domain. [5]

(c) Repeat the sub-question (a) above, now showing calculations in frequency-domain. [5]

(d) Repeat the sub-question (a) above, now showing calculations in s-domain. [5]

The End