

UNIVERSITI TUNKU ABDUL RAHMAN

ACADEMIC YEAR 2020/2021

MAY 2020 TRIMESTER

FINAL ASSESSMENT

UEEA1243 CIRCUIT THEORY

SATURDAY, 3 OCTOBER 2020

TIME: 9.00 AM – 12.00 PM (3 HOURS)

BACHELOR OF ENGINEERING (HONOURS) ELECTRICAL AND ELECTRONIC
ENGINEERING

BACHELOR OF ENGINEERING (HONOURS) BIOMEDICAL ENGINEERING

BACHELOR OF ENGINEERING (HONOURS) ELECTRONIC AND
COMMUNICATIONS ENGINEERING

BACHELOR OF ENGINEERING (HONOURS) ELECTRONICS (COMPUTER
NETWORKING)

BACHELOR OF ENGINEERING (HONOURS) MECHANICAL ENGINEERING

BACHELOR OF ENGINEERING (HONOURS) MECHATRONICS ENGINEERING

BACHELOR OF ENGINEERING (HONOURS) MATERIALS AND MANUFACTURING
ENGINEERING

BACHELOR OF ENGINEERING (HONOURS) CHEMICAL ENGINEERING

Instructions to Candidates:

REMINDER: You are reminded to read and adhere to the Final Assessment Instructions to Candidates that has been made available through the UTAR Portal before the commencement of Final Assessment (FA). The detailed instructions for this FA are as follows:

General

1. This Final Assessment (FA) is an individual, time restricted assessment which consists of FOUR (4) questions. Each question carries 25 marks.
2. You are required to answer **ALL** questions, and submit the **ANSWER SCRIPT** by **12.00 pm, 3 OCTOBER 2020**.
3. During the period of **3 hours** of this FA, the examiner(s) can be reached at
 - (a). Microsoft Teams, or
 - (b). Email: leeyingl@utar.edu.my, ycchang@utar.edu.my, chonglw@utar.edu.myYou may use the above e-platform(s) to check with the examiner(s) if you need any clarification on this FA question paper.

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4. You may refer to any books, lecture notes, published materials, online resources etc. when answering the questions. Proper referencing is necessary to avoid plagiarism. The preferred referencing style is American Psychological Association (APA) / Harvard / Chicago Manual. Candidates are reminded that **Copy-and-Paste, Consultation, Discussion and Sharing of Answers** with others are **STRICTLY PROHIBITED** in this FA.

Answer Script File

5. The answer script **MUST** be a **PDF file** in A4 size format. **Note: Please keep the file size NOT exceeding 30MB per file.**
6. Please check your Index Number generated by the Division of Examinations, Awards, and Scholarships (DEAS). You **MUST** name your answer script file using the following file name for submission:

UEEA1243_FA_3E_[Your Index Number]

For example, if you are from the degree programme 3E, and your Index Number is A99999EB3EF, then your answer script should be named as:

UEEA1243_FA_3E_A99999EB3EF.doc

Answer Script File Submission

7. Your answer script file has to be submitted to the following platform(s) before the due time/date.
 - (a). Attach your answer script at WBLE,
<http://ewble-sl.utar.edu.my/mod/assignment/view.php?id=269094>
 - (b). Send your answer script to the UEEA1243.LKCFES@utar.edu.my
Note: For the subject / title of your email, use the file name of your answer script, i.e.,
UEEA1243_FA_[Programme Abbreviation]_[Your Index Number]
8. Please make sure you submit the correct, complete and final version of your answer script and the same copy of answer script file is to be submitted to the above platform(s).

UEEA1243 CIRCUIT THEORY**Contents of Answer Script**

9. The **first page** of your submission is the **Final Assessment Cover Page**. You **MUST** use the template given and fill in the following information
 - Your Programme (Abbreviation)
 - Your Index Number
 - Your Name
 - Your Student ID
10. The **second page** of your submission is the **Final Assessment Declaration Statement**. You **MUST** use the template given, and digitally sign on the form to indicate the authenticity of your submitted work is without plagiarism.
11. Each question should be answered starting on a new page. It is recommended that the answer to each question is limited to **5 pages**.
12. For answer scripts that have text-based answers only, all texts **MUST** be typed and recommended using Times New Roman characters with font size **12**, with proper spacing and alignment, except for the drawings and equations/calculations.
13. For answer scripts that require / contain drawings, equations and calculations with short text descriptions, you can hand-write your answers on a blank paper, and then use the scanner apps in your smartphone (Scanner Document, CamScanner, Adobe Scanner etc.) to take scanned copy, or you can type if necessary and include the scanned copy taken in the Word document, as part of your submitted answers.
14. Please include a page number on **each and every page** of your answer script. Ensure that each page of answer scripts is in sequence prior to online submission.

WARNING OF PLAGIARISM

15. Answer scripts shall be uploaded to Turnitin to check for the originality of submitted answers. In the case of suspected plagiarism, the evidence will be submitted to the Examination Disciplinary Committee of the University. Disciplinary action shall be taken against any candidate who is found to have plagiarized in the answer submitted. Hence, candidates are reminded to abide by all University Rules and Regulations and any instructions/guidelines relating to examinations/assessments.

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- Q1. (a) For the circuit shown in Figure Q1(a), determine R_{ab} , which is the equivalent resistance at terminals a - b . (10 marks)

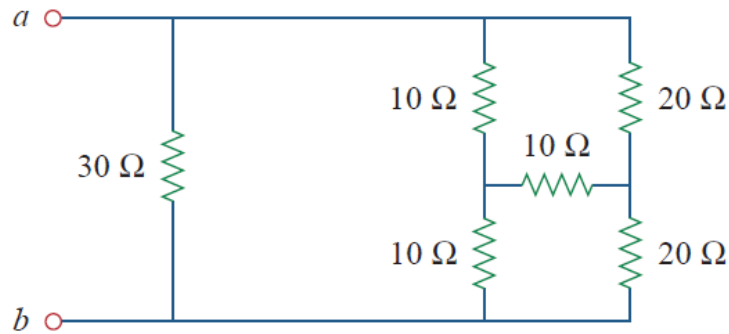


Figure Q1(a)

- (b) With the use of Kirchhoff's Current Law (KCL), determine i_1 , i_2 and i_3 shown in Figure Q1(b). (3 marks)

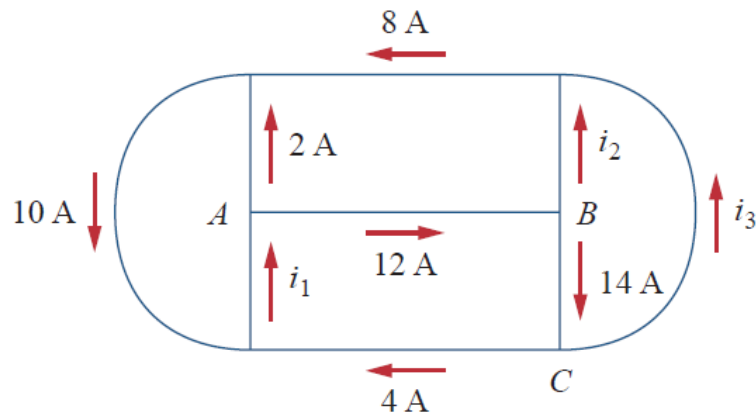


Figure Q1(b)

- (c) With the use of mesh analysis, determine mesh currents i_1 and i_2 shown in Figure Q1(c). (8 marks)

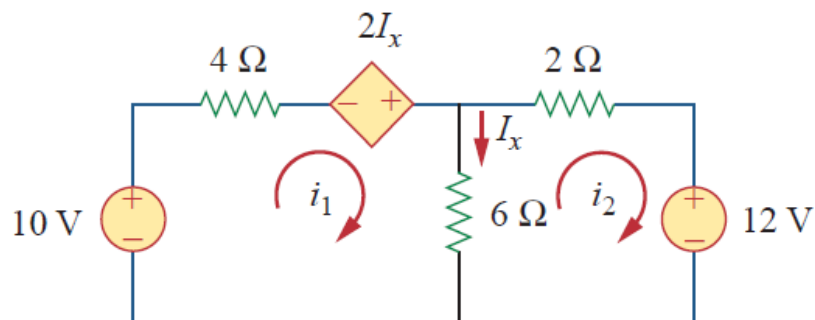


Figure Q1(c)

UEEA1243 CIRCUIT THEORY**Q1. (Continued)**

- (d) Determine V_o shown in Figure Q1(d). (4 marks)

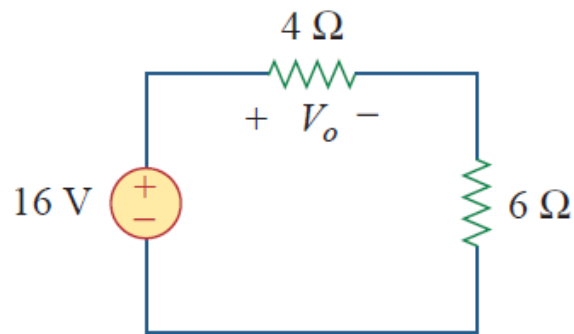


Figure Q1(d)

[Total : 25 marks]

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- Q2. (a) Calculate the voltage v in the circuit of Figure Q2(a) using the principle of superposition. (13 marks)

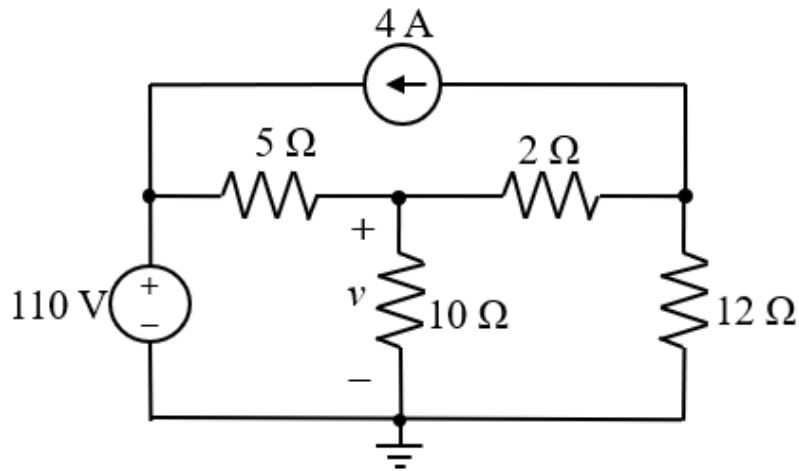


Figure Q2(a)

- (b) Analyze the circuit of Figure Q2(b) by finding its Thevenin equivalent with respect to the terminals a-b. (12 marks)

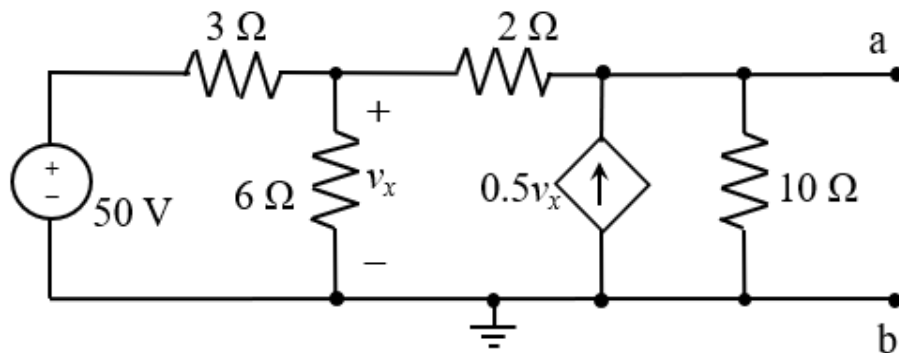


Figure Q2(b)

[Total : 25 marks]

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- Q3. (a) The switch in the circuit of Figure Q3(a) has been open for a long time. At $t = 0$, the switch is closed. Analyze the circuit by finding the expressions for $i(t)$ and $v(t)$ when $t > 0$. (8 marks)

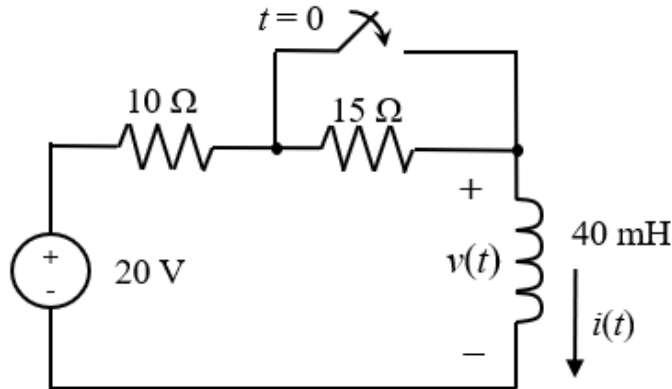


Figure Q3(a)

- (b) Consider the schematic of an AC circuit given in Figure Q3(b). Solve the following questions by applying Thevenin's theorem across terminal $a-b$ of the circuit:
- Determine the equivalent impedance across the terminal $a-b$ in phasor form. (3 marks)
 - Determine the equivalent voltage across the terminal $a-b$ in phasor form. (6 marks)
 - Draw the Thevenin equivalent circuit and Norton equivalent circuit. Clearly label the rating of the components of the circuits. (4 marks)
 - The load impedance Z_L comprises a 2Ω load in series with a Z_1 load ($Z_L = 2\Omega + Z_1$). Identify the impedance of Z_1 (in phasor form) for maximum power transfer and calculate the current flow through the terminal $a-b$. (4 marks)

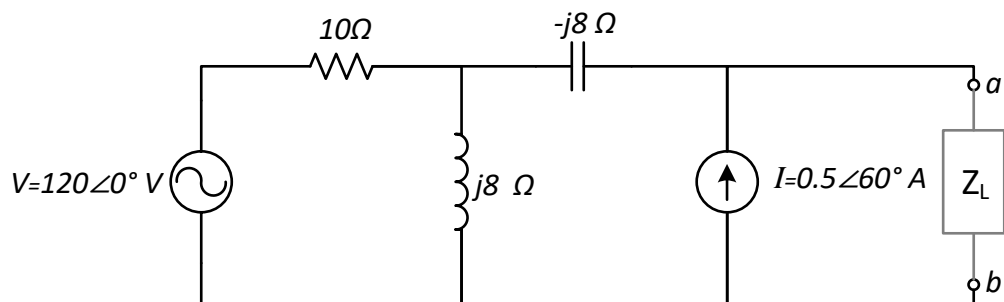


Figure Q3(b)

[Total : 25 marks]

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Q4. (a) Refer to the circuit in Figure Q4(a) with a 120 V, 60 Hz voltage source. Calculate the following:

- (i) The total impedance of the circuit. (3 marks)
- (ii) The current, I . (2 marks)
- (iii) The power factor, real power, reactive power, and apparent power delivered by the voltage source. (6 marks)
- (iv) Sketch the equivalent impedance triangle and power triangle of the circuit. (4 marks)

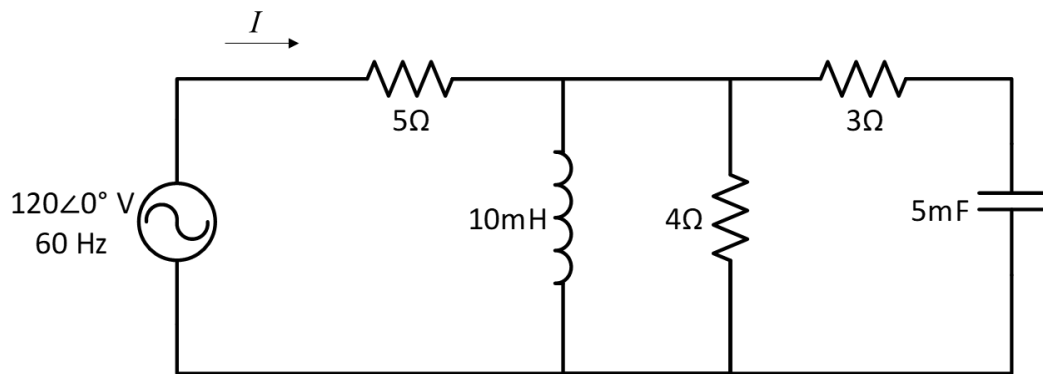


Figure Q4(a)

(b) An electrical system with a 120 V, 60 Hz voltage source has the following two loads connected in parallel:

Load A: 270 VAR, 0.6 power factor lagging

Load B: 200 W, 0.75 power factor leading

- (i) Calculate the average power, reactive power, and phase angle of each load. (4 marks)
- (ii) Determine the total complex power. (2 marks)
- (iii) Identify the capacitance necessary to raise the power factor to unity. (4 marks)

[Total : 25 marks]