

TUNKU ABDUL RAHMAN UNIVERSITY OF MANAGEMENT AND TECHNOLOGY

FACULTY OF ENGINEERING AND TECHNOLOGY

ACADEMIC YEAR 2022/2023

JANUARY EXAMINATION

AGEL1523 PRINCIPLES OF ELECTRICAL AND ELECTRONIC ENGINEERING

MONDAY, 9 JANUARY 2023

TIME: 2.00 PM – 4.00 PM (2 HOURS)

DIPLOMA OF ELECTRONIC ENGINEERING

Instructions to Candidates:

Answer **ALL** questions.

All questions carry equal marks.

AGEL1523 PRINCIPLES OF ELECTRICAL AND ELECTRONIC ENGINEERING**Question 1**

- a) Explain how a Wheatstone bridge can be used to determine the value of an unknown resistance. Draw and label the Wheatstone bridge used in the explanation. (8 marks)
- b) An ammeter with an internal resistance of $50\ \Omega$ is used to measure the current of a $500\ \Omega$ load that is connected in series to a 10V supply. Calculate the theoretical value of the load current and the actual ammeter reading. (4 marks)
- c) Based on the resistive circuit in Figure Q1:

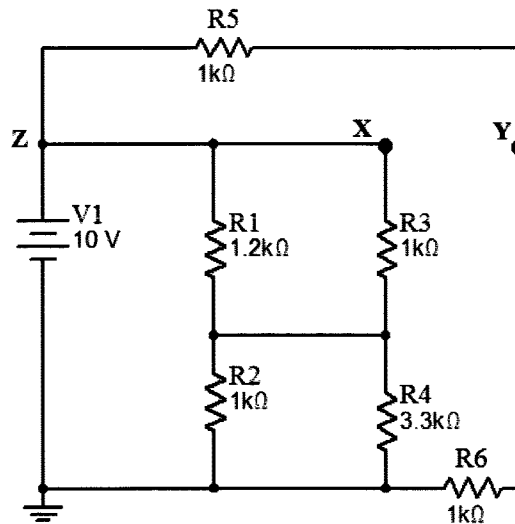


Figure Q1

- i) Calculate the current through resistor R_6 using the current divider rule. (4 marks)
- ii) Use an alternative method to determine the current of resistor R_6 . (3 marks)
- iii) Explain the effect of connecting a wire between point X and point Y. Next, calculate the total resistance of the modified circuit. (6 marks)

[Total: 25 marks]

AGEL1523 PRINCIPLES OF ELECTRICAL AND ELECTRONIC ENGINEERING**Question 2**

- a) The Superposition Theorem allows a circuit with multiple sources to be analyzed by evaluating only one independent source at a time. Identify any TWO (2) prerequisites for the theorem application. (4 marks)
- b) Convert the circuit of Figure Q2 (a) into a parallel circuit using source conversion. Next, determine the voltage across resistor R_5 . (10 marks)

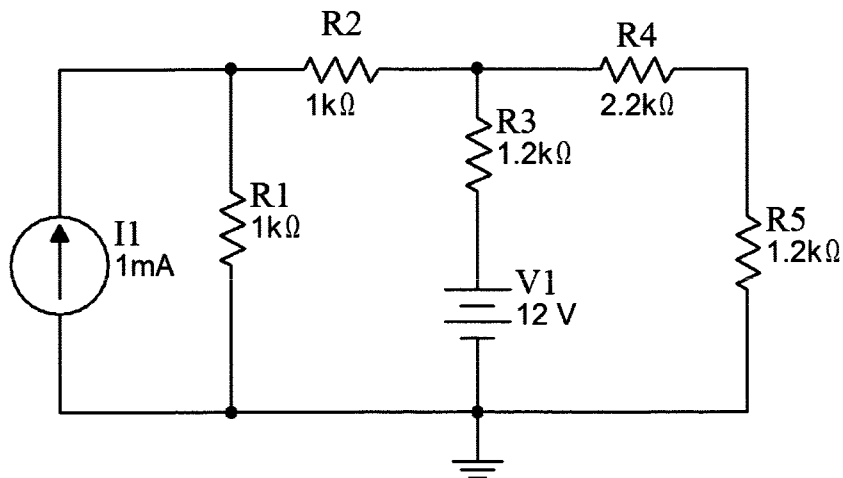


Figure Q2 (a)

- c) Consider the circuit in Figure Q2 (b). Determine the voltage across resistor R_2 using Superposition Theorem. (11 marks)

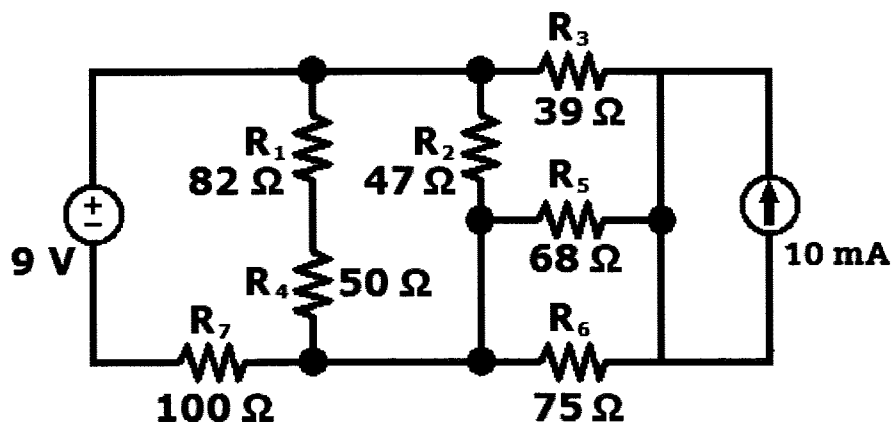


Figure Q2 (b)

[Total: 25 marks]

AGEL1523 PRINCIPLES OF ELECTRICAL AND ELECTRONIC ENGINEERING**Question 3**

- a) Define *node* in the context of an electric circuit and identify all the nodes in the circuit of Figure Q3 (a). (4 marks)

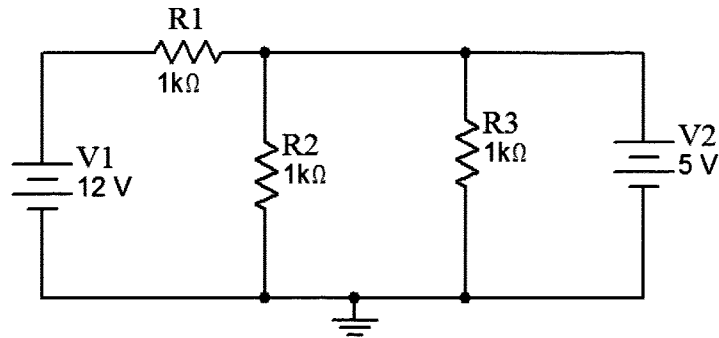


Figure Q3 (a)

- b) Figure Q3 (b) shows a multi-loop resistive circuit.

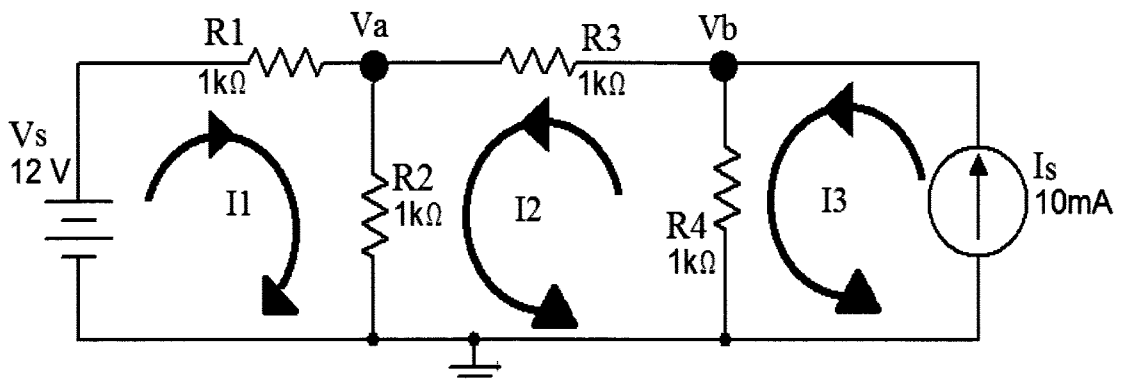
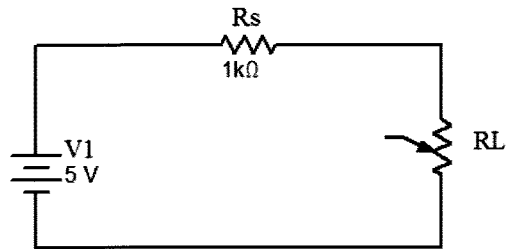


Figure Q3 (b)

- i) Calculate mesh currents I_1 , I_2 and I_3 using mesh analysis. Next, determine the voltage across resistor R_3 . (11 marks)
- ii) Calculate node voltages V_a and V_b using nodal analysis. Next, determine the voltage across resistor R_3 . (10 marks)
- [Total: 25 marks]

AGEL1523 PRINCIPLES OF ELECTRICAL AND ELECTRONIC ENGINEERING**Question 4**

- a) Define the *Maximum Power Transfer Theorem*. Give a numerical example using the circuit shown in Figure Q4 (a) to support the definition. (6 marks)



Note: R_L is a variable resistor

Figure Q4 (a)

- b) Consider the circuit that is shown in Figure Q4 (b). Determine the voltage across resistor R_3 using:

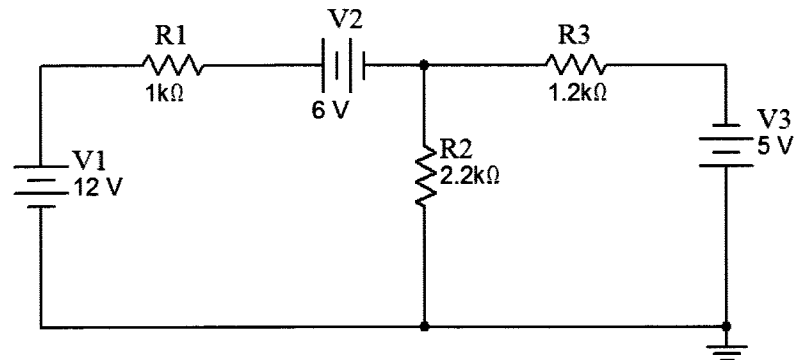


Figure Q4 (b)

- i) Thevenin's Theorem. (9 marks)
- ii) Norton's Theorem. (10 marks)

[Total: 25 marks]