

The Open University of Sri Lanka
Faculty of Engineering Technology
Department of Mechanical Engineering



0069

Study Programme : Bachelor of Science Honours in Engineering
Name of the Examination : Final Examination
Course Code and Title : DMX3304 Applied Electronics
Academic Year : 2024/25
Date : 06th February 2026
Time : 0930-1230h
Duration : 3 hours

General instructions

1. Read all instructions carefully before answering the questions.
2. This question paper consists of **Five (5)** questions in **Six (6)** pages.
3. Answer **all** questions.
4. All questions carry equal marks.
5. Answer for each question should commence from a new page.
6. This is a Closed Book Test (**CBT**).

Question 01

- a. Compare the following pairs using an appropriate circuit diagram (09 marks)
example for each case.

- i.) Kirchhoff Voltage Law and Kirchhoff Current Law
- ii.) Nodal Analysis and Mesh Analysis
- iii.) Thevenin Theorem and Norton Theorem

- b. Consider the circuit diagram given in Figure Q1.1. (05 marks)

If 18V source delivers 8A of current and v_x source delivers 13A of current, determine:

- i.) Number of branches and nodes
- ii.) Current i_x
- iii.) Source voltage of v_x
- iv.) Value of R_A

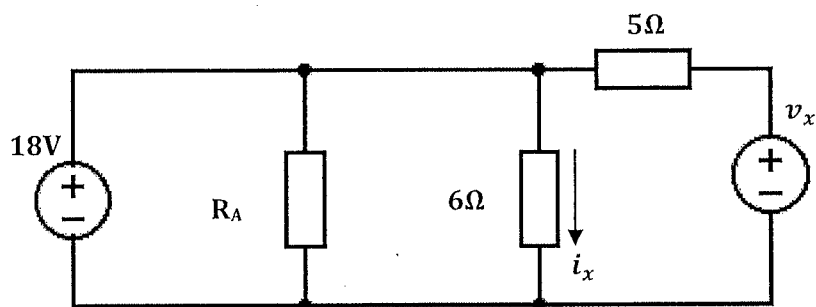


Figure Q1.1

- c. Consider the circuit given in Figure Q1.2. If 60V voltage source delivers 5A of current, determine: (06 marks)
- Currents flowing through each branch
 - Value of v_y

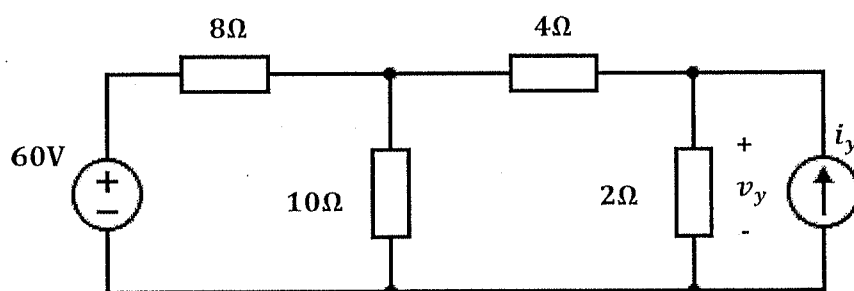


Figure Q1.2

Question 02

- Compare the differences of a **signal diode** and a **Zener diode** with the help of V-I characteristic curves. (04 marks)
- For the diode circuit of Figure Q2.1, calculate the currents I_1 , I_2 as functions of the supply voltage V_s and diode voltage $V_D = 0.7V$ for all diodes. (06 marks)

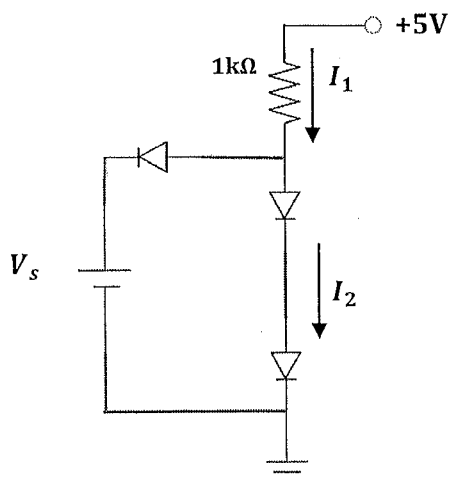


Figure Q2.1

- c. What are two main applications of a Transistor? Explain using the V-I characteristic curve. (04 marks)
- d. The **PNP** transistor shown in the circuit of Figure Q2.2 has $\beta = 160$ and negligible reverse saturation current. Determine:
- I_C
 - V_{CE}

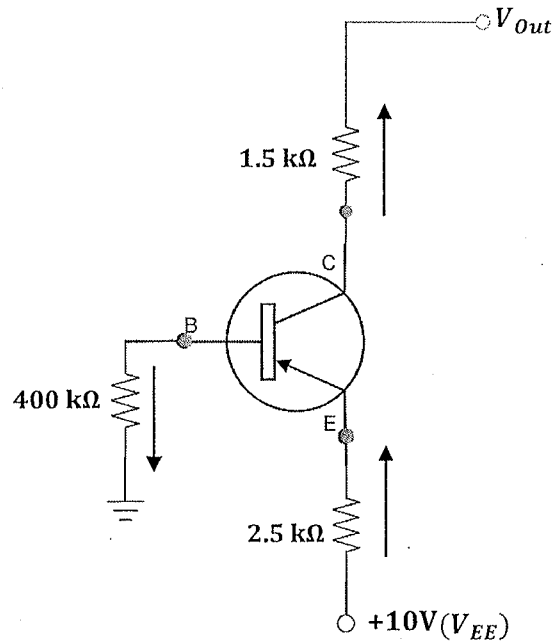


Figure Q2.2

Question 03

- a. Define superposition theorem using appropriate circuit diagrams. (04 marks)
- b. Consider circuit given in Figure 3.1. (08 marks)

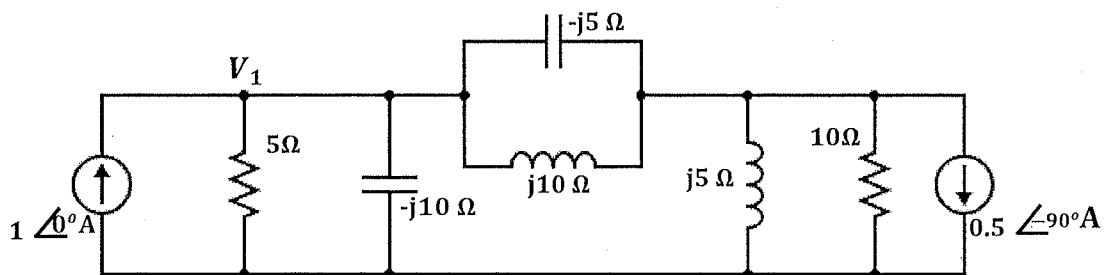


Figure Q3.1

- Simplify the circuit with corresponding impedances and **re-draw** the circuit. Clearly indicate the impedance values.
- Find the value of V_1 using **superposition theorem**.

- c. Consider the following Wheatstone bridge circuit given in Figure Q3.2 used to measure an unknown resistance R_x . Determine:

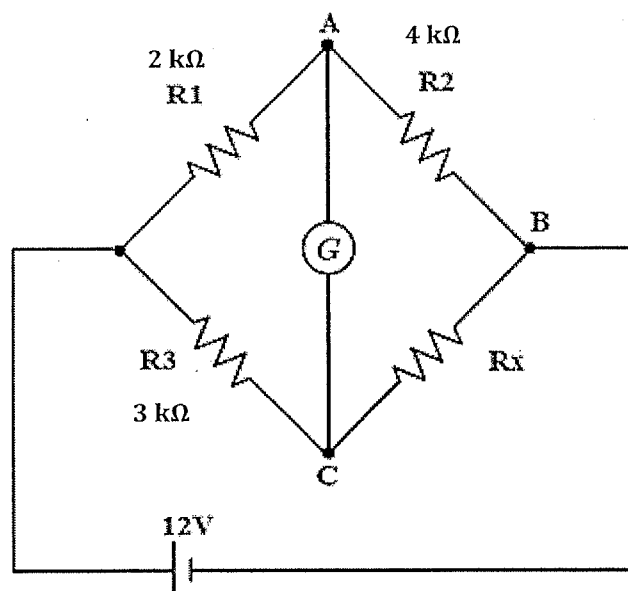


Figure Q3.2

If R_x changes to $6\text{k}\Omega$ determine:

- i.) The voltage at point A (V_A)
- ii.) The voltage at point C (V_C)
- iii.) The bridge voltage (V_{AC}) when $R_x = 6\text{k}\Omega$

(01 marks)

(01 marks)

(01 marks)

If R_x changes to $6.5\text{k}\Omega$ determine:

- iv.) The new voltage at point C (V_C)
- v.) The new bridge voltage (V_{AC})
- vi.) State whether this change indicates an increase or decrease in the bridge voltage.

(02 marks)

(02 marks)

(01 marks)

Question 04

- a. Compare Passive electronic components and Active electronic components. Provide three examples for each category. (06 marks)
- b. Answer the following questions based on the knowledge you gained under the LAB experiment of OPAMP.
 - i.) Draw the corresponding symbol and the IC (IC741) of an OPAMP. Clearly mark important terminals. (04 marks)
 - ii.) Why OPAMPs are important and provide 04 applications. (03 marks)

c. An OPAMP circuit is given in Figure Q4.1.

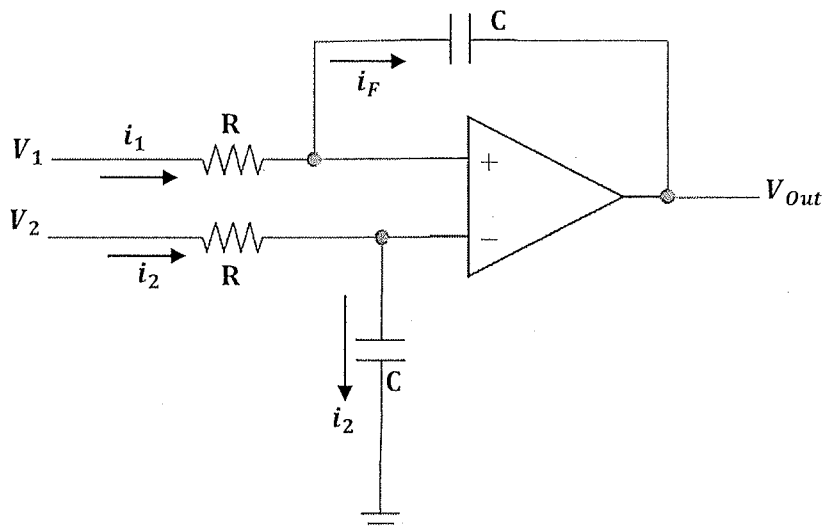


Figure Q4.1

Derive an expression for the output voltage V_{out} as a function of time and hence find the type of the application of this circuit.

Question 05

A smart home security system needs to trigger (activate) an **alarm (A)** based on three inputs:

Inputs	Output = 1	Output = 0
Window Sensor (W)	Window is Open	Window is Closed
Motion Detector (M)	Motion Detected	Not Detected
Time Sensor (T)	Nighttime	Daytime

The alarm should trigger (activate) under the following conditions:

Condition 1: If the window is open during nighttime, and motion is not detected

Condition 2: If motion is detected during nighttime with windows closed

Condition 3: If the window is open and motion is detected during daytime

Condition 4: If the window is open and motion is detected during nighttime

- a. Create a complete truth table for all input combinations. (04 marks)
- b. Write the Boolean expression for this system using Sum of Products (SOP) form and Product of Sum (POS) form. (04 marks)
- c. Simplify the Boolean expression obtained for SOP form using following methods: (08 marks)
 - i.) Boolean algebra laws.
 - ii.) K- Map
- d. Design the simplified logic circuit **only** using **basic logic gates**. (04 marks)