

University of Ruhuna- Faculty of Technology
Bachelor of Biosystems Technology Honours Degree
Level 1 (Semester II) Examination, November 2025
Academic year 2023/2024

Course Unit: BST 1222 Electronics for Biosystems Technology (Written) Duration: 1.5 hours

Instructions to candidates of the question paper.

- Answer all four (04) questions.
- Each question carries twenty (20) marks.
- This is a closed-book examination. All written and printed materials, as well as electronics devices including laptops and mobile phones, are not allowed during the examination.
- All symbols and abbreviations have their usual meaning.
- Clearly state all the assumptions you made.

1.

a)

- I. Define the term **Electrical Voltage**. (2 marks)
- II. Calculate the total charge of 4.6875×10^{20} electrons in coulombs. (3 marks)
- III. If a battery delivers **1500 J** of energy supplying the charge calculated in Part II, determine the voltage of the battery. (3 marks)

b) List three (03) common uses of a multimeter for diagnosing and measuring electrical circuits. (3 marks)

c) A **48 V, 60 Ah** Battery is connected to an electrical system that draws a constant current of **12 A**. Explain the significance of the ampere-hour (**Ah**) rating of the battery and calculate its approximate operating time under these conditions. (Assume ideal conditions and neglect any efficiency losses). (6 marks)

d) Express the value in Table 01, in each of the given formats (Write your answers in the answer script). (3 marks)

Table 01

Value	Scientific Notation	Engineering Notation	Metric Prefix Notation
0.00047 V			

2.

a) Consider the circuit shown in Figure 1.

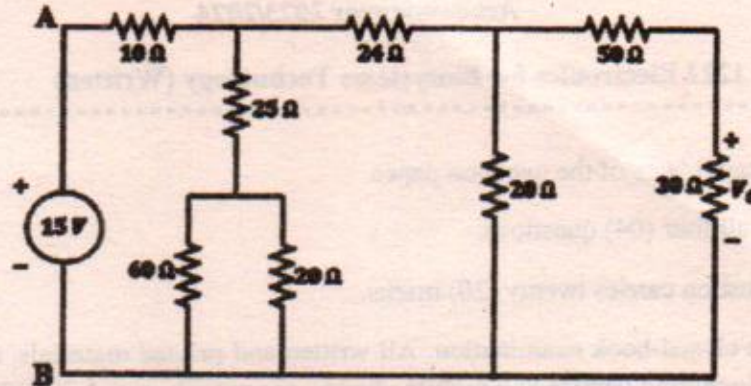


Figure 1

- I. Assuming AB is an open circuit, calculate the equivalent resistance (R_{eq}) across terminals A and B. (6 marks)
- II. Determine the total current supplied by the voltage source. (4 marks)

b) Consider the circuit shown in Figure 2.

- I. Define the reference node and write the nodal voltage equations. (6 marks)
- II. Solve the equations in part I to determine the node voltages V_1 and V_2 . (4 marks)

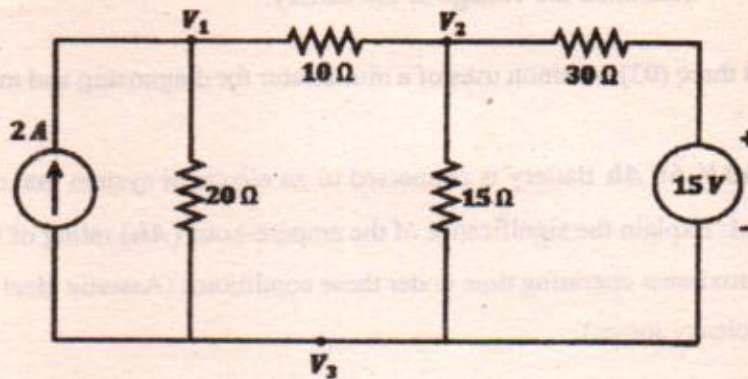


Figure 2

3.

a) Classify electrical materials according to their three (03) main categories. (3 marks)

b)

I. Identify the parts A, B, and C shown in Figure 3. (3 marks)

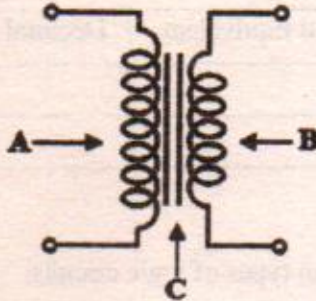


Figure 3

II. Compare a step-up transformer and a step-down transformer with respect to three (03) factors. (3 marks)

III. State the role of a rectifier in a DC power supply. (2 marks)

IV. Classify the main types of rectifiers. (2 marks)

c) Consider a bridge rectifier circuit shown in Figure 4, with a transformer having a turn ratio $10 : 1$. The primary of the transformer is connected to an AC supply of $230\text{ V}, 50\text{ Hz}$. Assume all diodes are ideal.



Figure 4

I. Calculate the DC output voltage of the bridge rectifier. (3 marks)

II. Determine the peak inverse voltage (PIV) of output. (2 marks)

III. Find the ripple frequency of the rectifier output. (2 marks)

4.

- a) Convert each of the binary numbers listed in Table 02 into its octal, decimal, and hexadecimal representations (Write your answers in the answer script). (6 marks)

Table 02

Binary Number	Octal Equivalent	Decimal Equivalent	Hexadecimal Equivalent
110011			
10011010			

- b) Identify the two (02) main types of logic circuits. (2 marks)
- c) It is required to design a logic control circuit based on the following requirements for an automated water management system to pump water from a well to a tank.

Inputs:

- Water level of Tank (T): 0 = insufficient, 1 = sufficient
- Water level of Well (W): 0 = insufficient, 1 = sufficient

Outputs:

- Pump (P) turns on when water in the tank is insufficient and water in the well is sufficient.
 - Yellow Indicator (Y) turns on when water in the tank is sufficient and water in the well is insufficient.
 - Red Indicator (R) turns on when both tank and the well have insufficient water.
- I. Construct the truth table for the three outputs considering all input-output combinations. (6 marks)
- II. Derive the Boolean expressions for the pump and two indicators. (6 marks)

.....**End of Paper**.....