The Open University of Sri Lanka
Faculty of Engineering Technology
Department of Electrical & Computer Engineering

Study Programme	: Bachelor of Technology Honours in Engineering
Name of the Examination	: Final Examination
Course Code and Title	**: EEX3331 Electrical Measurements and Instrumentation**
Academic Year	: 2020/21
Date	: 11th February 2022
Time	: 1400 - 1700 hrs
Duration	: **3 hours**

General Instructions

1. Read all instructions carefully before answering the questions.

2. This question paper consists of **Six (6)** questions in **Four (4)** pages.

3. Answer any **Five (5)** questions. All questions carry equal marks.

4. Answer for each question should commence from a new page.

5. No charts/ codes are provided.

6. This is a Closed Book Test (CBT).

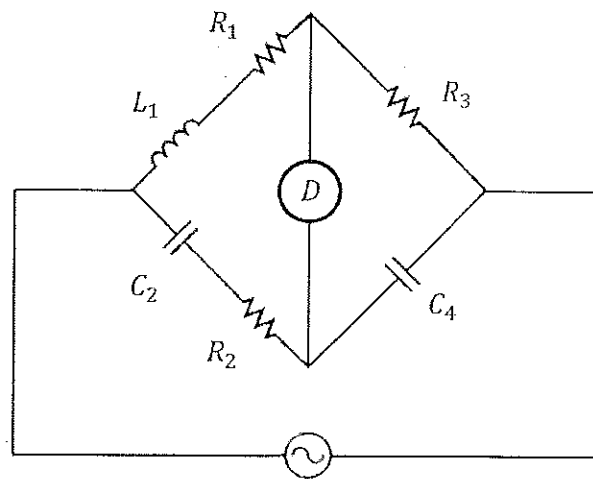7. Answers should be in clear handwriting.

8. Do not use Red colour pen.

Figure 03

v. Draw sketches to illustrate the locus of variation of out of balance voltage in the complex domain, when varying following parameter sets. *(06 marks)*
   a. C_2 and R_2
   b. C_4 and R_3
   c. R_2 and R_3

vi. Based on the locus of variations you have sketched in 'v', determine the most suitable pair of components to achieve the balanced condition. Justify your answer.

(02 marks)

Question 05

An experiment was conducted to calculate the earth resistivity using Wenner method. The readings are as follows,

Total span between the electrodes at the two ends – 15 m

Electrode depth – 0.5 m

Measured voltage – 102.5 V

Measured current – 1.75 A

i. Calculate the earth resistivity using Wenner's full equation. *(02 marks)*

ii. Recalculate the earth resistivity using the Wenner's approximated equation indicating the neglected parameters appropriately. *(02 marks)*

iii. Compare Wenner method with the Schlumberger method, considering at least one of their advantages and disadvantages. *(06 marks)*

iv. State two factors that affect the earth resistivity and briefly describe how they affect the earth resistivity. *(04 marks)*

v.   Briefly describe the two methods 'Fall of potential' and 'Dead Earth' of measuring earth resistance. With the help of appropriate diagrams, state which of the methods gives the more accurate measurement. Give reason(s). *(06 marks)*

Question 06

Briefly describe the following topics. You may use relevant circuit diagram(s) and equation(s) where applicable. Do not exceed two pages per each description.

i.   Measurement of iron loss and permeability using Maxwell's bridge.   *(06 marks)*

ii. Use of Wagner earthing device to reduce errors in AC bridges due to stray capacitance. *(06 marks)*

iii. Use of X-Y mode of the oscilloscope to plot the Hysteresis (B-H loop) of a magnetic specimen.   *(08 marks)*

Important equations

Wenner's full equation for earth resistivity calculation.

$$\rho = \frac{4\pi a R}{1 + \dfrac{2a}{\sqrt{a^2 + 4b^2}} - \dfrac{2a}{\sqrt{4a^2 + 4b^2}}}$$

a = space between electrodes

b = depth of the electrodes

R = measured resistance