(15)

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)
DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

Mid-Semester Examination
Course No.: EEE 4603
Course Title: Measurement and Instrumentation

Summer Semester, A. Y. 2021-2022
Time: 90 Minutes
Full Marks: 75

There are 2 **(two)** questions. Answer all 2 **(two)** questions. The symbols have their usual meanings. Programmable calculators are not allowed. Marks of each question and corresponding COs and POs are written in the brackets.

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1. a) Explain gross and systematic errors with proper examples. **4 (CO1, PO3)**

   b) Find an expression for the gauge factor of a strain gauge. **10 (CO1, PO3)**

   c) Explain one differential arrangement of capacitive transducer and why it is advantageous over inductive transducers. **6 (CO1, PO3)**

   d) Find the expression for the quality factor of Maxwell Bridge with a proper bridge circuit and explain why it's not suitable for measuring inductance with low quality factor. **10 (CO1, PO3)**

2. a) Calculate the error from the following expression: **10 (CO2, PO2)**

$$w = \frac{x^2 y}{z}$$

   Here x = 10±0.2, y = 15±0.3, z = 20±0.2.

   b) A Kelvin double bridge (Fig:1) has ratio arms P=Q=p=q= 1000 Ω. The emf of the battery is 100 V and a resistance of 5 Ω is included internally. The galvanometer has a resistance of 500 Ω and the resistance of the link connecting the unknown resistance to the standard resistance may be neglected. The galvanometer has null deflection when S= 0.001 Ω. **15 (CO2, PO2)**

      i) Calculate the value of the unknown resistance.

      ii) Calculate the current through the unknown resistance R at balanced condition.

      iii) Calculate the deflection of the galvanometer when the unknown resistance, R, is changed by 0.1 percent from its value at balance. It has a sensitivity of 200 mm/uA.

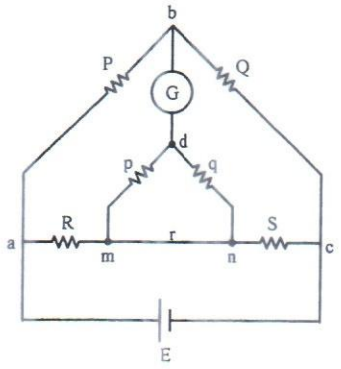

Fig: 1

c) A Wheatstone bridge has ratio arms of 1k Ω and 100 Ω. Its is being used to measure an unknown resistance of 25 Ω. Two galvanometers are available at hand. Galvanometer **A** has a resistance of 50 Ω and a sensitivity of 200 mm/uA and galvanometer **B** has values of 600 Ω and 500 mm/uA. Calculate the ratio of their sensitivities and find out which one is more sensitive. **10 (CO2, PO2)**

d) For the Maxwell's bridge (Fig: 2) R_3=10 Ω, C= 0.5 mF, R_1= 320 Ω and R_2= 20 Ω at balance. Calculate the Q-factor for the unknown impedance at a supply frequency of 50 Hz. **10 (CO2, PO2)**

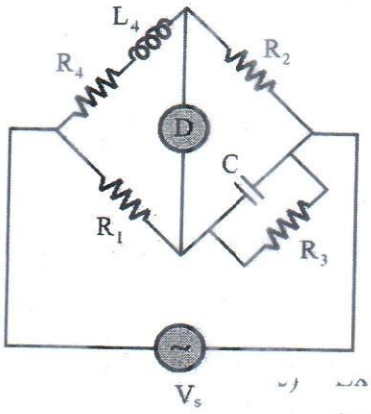

Fig: 2