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Department of Electrical and Electronic Engineering
Faculty of Engineering
Midterm Examination, Fall – 2026

Course Code: 0713-325 | Course Title: Measurement and Instrumentation
Section: A, B, C & D | Level-Term: L3-T2 | Teacher's Initial: NH, BS
Full Marks: 25 | Exam Date: October 28, 2026 | Time: 1.5 Hours

Answer all the question. The number on the rightmost side of the question indicates the marks.

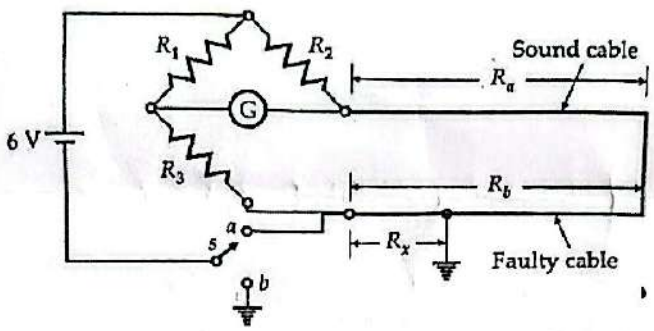
Q1. **Illustrate** the block diagram of a basic measurement system, label each functional element, and **explain** briefly the role of each block in the measurement process. CO-1 C(2) 5

Q2. The Schering bridge balances under the following conditions: R1 = 10 kΩ, R2 = 1 kΩ, C1 = 100 pF, C3 = 400 pF. The bridge is driven by a 1 kHz sinusoidal source. CO-2 C(3) 5

a) **Determine** the values of Rs, Cs, and Dissipation factor.

b) If the series combination of Rs and Cs is to be replaced by a parallel combination Rp and Cp, Prove that $C_p = \frac{C_s}{1+D^2}$ $R_p = R_s(1+Q^2)$

Q3. CO-2 C(3) 3



a) A Wheatstone bridge is connected for a Varley loop test as shown in the Fig. above. When the switch is in' position a, the bridge is balanced with R1 = 1000 Ω R2 = 100 Ω, R3 = 53 Ω. When switch S is in position b, the bridge is balanced with R1 = 1000 Ω, R2 = 100 Ω and R3=52.9 Ω. If the resistance of the shorted wire is 0.015 Ω/m. **Determine** the distance between the place of fault and the bridge?

b) A Wheatstone bridge has ratio arms $R1 = 1.2\ k\Omega$ and $R2 = 120\ \Omega$. It measures an unknown $Rx \approx 40\ \Omega$. At balance, the third arm is $R3$. Two galvanometers are available: $G1$: $Rg = 40\ \Omega$, $S = 180mm/\mu A$ $G2$: $Rg = 450\ \Omega$, $S = 420mm/\mu A$. Which Galvanometer is more sensitive to a small unbalance? **Comment** on the result. What shunt across G_2 would make it as sensitive as G_1? CO-2 C(4) 3

Q4. Explain the piezoresistive effect in materials. **Develop** the expression for the gauge factor when a tensile stress S is applied to the wire in figure 1. (*The change in resistivity due to strain is negligible)* CO-3 C(3) 4

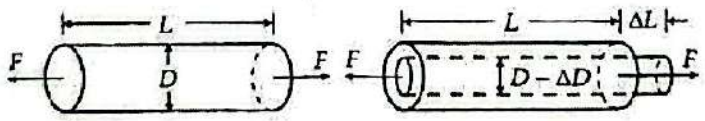


Figure 1: Change in dimensions of a strain gauge element when subjected to a tensile force.

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5. a) **Construct** the output of the Capacitive displacement sensor shown in the figure 2 and comment on its linearity. CO-3 C(3)

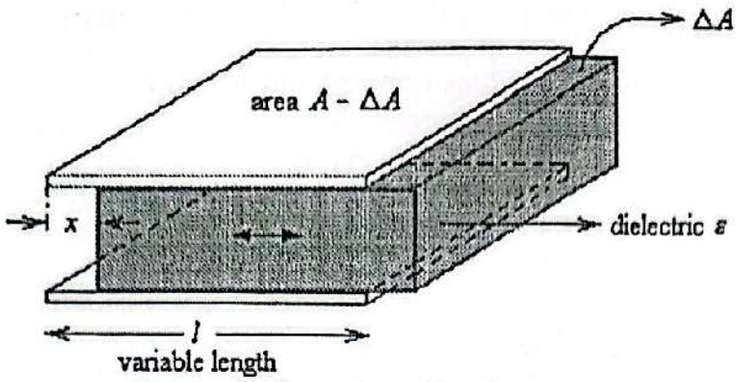


Figure 2: Capacitive Displacement sensor

b) Suppose you are given two sensors, one is an RTD and the other is a thermistor. **Investigate** out of these two, which one will you use for temperature compensation for circuit network application and why? CO-3 C(4)

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