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SCHOOL OF ENGINEERING
END TERM EXAMINATION - JAN 2023

Semester : Semester III - 2021
Course Code : ECE3015
Course Name : Sem III - ECE3015 - Measuring Instruments and Sensors
Program : B.Tech. Electronics and Communication Engineering

Date : 18-JAN-2023
Time : 1.00PM - 4.00PM
Max Marks : 100
Weightage : 50%

Instructions:
(i) Read all questions carefully and answer accordingly.
(ii) Question paper consists of 3 parts.
(iii) Scientific and non-programmable calculator are permitted.

PART A

ANSWER ALL THE FIVE QUESTIONS   **5 X 2 = 10M**

1. For a dual ADC Type 3.5 digit DVM, the reference voltage is 100mV and the first integration is set to 300ms for some input voltage the disintegration period is 370.2ms. What will the DVM will indicate if
(a) Direct range is used (b) (0 – 20 V) is used (c) (0 – 200 V) is used

(CO2) [Knowledge]

2. Transducers are devices, which convert variations in physical quantity which is non – electrical such as temperature, pressure, sound, light etc. in to an equivalent electrical signal (voltage, current etc). Define Active, Passive transducers with example.

(CO2) [Knowledge]

3. The gauge factor of measuring instruments is defined as the ratio of per unit change in resistance to per unit change in length and Modulus of elasticity is defined as per Hooke's law, up to the proportional limit for small deformation stress is directly proportional to strain. Write down the Formula for finding both of Gauge Factor and Modulus of Elasticity?

(CO3) [Knowledge]

4. Capacitive transducers are used to measure physical quantities like pressure,displacement and temperature by changing the capacitance. In which of the two situations can capacitive transducers be used - static measurement or dynamic measurement? Give a short justification for your answer.

(CO3) [Knowledge]

5. The transducer which converts a mechanical displacement proportionally into electrical signal and it producing an output voltage of 2.6 V for displacement of 0.4 mm. Calculate the sensitivity of this transducer.

(CO3) [Knowledge]

PART B

ANSWER ALL THE TWO QUESTIONS   **2 X 15 = 30M**

6. A measuring system exists to provide information about the physical value of some variable being measured.
    a) Explain the methods of measurement with an example.
    b) Static characteristics of measuring instruments.

                                                        (CO1) [Comprehension]

7. The Cathode Ray Oscilloscope (CRO) is a very useful and versatile laboratory instrument used for display, measurement and analysis of waveform and other phenomena in electrical and electronic circuits. Explain how the luminous spot is produced by a beam of electrons upon striking a fluorescent screen.

                                                        (CO2) [Comprehension]

PART C

ANSWER ALL THE THREE QUESTIONS   **3 X 20 = 60M**

8. Identify the AC bridge given below which consists of a source, a balance detector and four arms. It is a modified version of a Wheatstone bridge, which is used to measure the self-inductance of a circuit. It works on the principle of null deflection method (also known as the "bridge method") to calculate an unknown inductance i in a circuit. Compute its balanced condition.
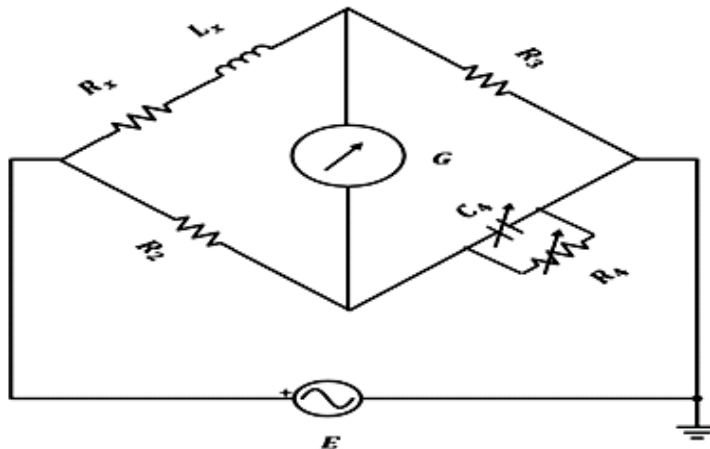
    b) A Maxwell bridge is a modification to a Wheatstone bridge used to measure an unknown inductance in terms of calibrated resistance and inductance or resistance and capacitance. Explain the types of Maxwell's bridge, which are used to determine the self-inductance of the circuit.
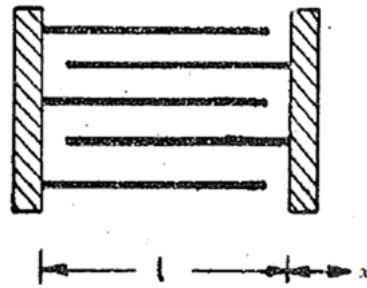
                                                     (CO2) [Application]

9. For measuring the liquid pressure during an experiment, Bourdone tube is used which is a sensor that converts pressure into displacement. Identify a transducer that can be used to convert the displacement into electrical signal. With neat sketch explain its construction, working ,advantages and disadvantages.

                                                     (CO3) [Application]

10. The capacitive transducers work on the principle of change in the capacitance of the capacitor. This change in capacitance could be caused by the change in the overlapping area, A of the plates, the change in the distance d between the plates, and the change in the medium between the plates ϵr, determine the change in the capacitance with respect to the variation of all above factors and also calculate sensitivity.

b) Figure shows a capacitive transducer using 5 plates. The dimensions of each plates are 25 mm X 25 mm and the distance between the plates is 0.25 mm. This arrangement is to be used for the measurement of displacement by observing the change in capacitance with the distance x. Calculate the sensitivity of the device. Assume that the plates are separated by air. The permittivity of air is $8.852 \times 10^{-12} F/m$.

(CO3) [Application]

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