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**PRESIDENCY UNIVERSITY BENGALURU**

**SCHOOL OF ENGINEERING**

**SUMMER TERM END TERM EXAMINATION – AUGUST 2024**

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| **Semester :IV** | **Date :5-8-2024** |
| **Course Code :ECE3015** | **Time :9:30AM to 12:30PM** |
| **Course Name :MEASURING INSTRUMENTS AND SENSORS** | **Max Marks :100** |
| **Program :B.TECH** | **Weightage : 50%** |

**Instructions:**

1. *Read all questions carefully and answer accordingly.*
2. *Question paper consists of 3 parts.*
3. *Scientific and non-programmable calculator are permitted.*
4. *Do not write any information on the question paper other than Roll Number.*

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| **PART A** |
| **ANSWER ANY 5 QUESTIONS 5Q X 2M=10M** |

1. Transducers are devices, which converts 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 transducer with example.

(CO1) [Knowledge]

1. Static characteristics of measuring instruments refer to the properties that describe their behavior under stable conditions, without any dynamic changes. Define accuracy and precision in the context of measurements, illustrating their differences with examples (CO1) [Knowledge]
2. A bridge circuit is a topology of electrical circuitry in which two circuit branches (usually in parallel with each other) are "bridged" by a third branch connected between the first two branches at some intermediate point along them. The bridge was originally developed for laboratory measurement purposes and one of the intermediate bridging points is often adjustable when so used. Bridge circuits now find many applications, both linear and non-linear, including in instrumentation, filtering and power conversion. A. C. bridges are used for measurement of inductance and capacitance. Identify a bridge that can be used to measure unknown capacitance and label the circuit diagram (CO3) [Knowledge]
3. A meter reads 127.50 V and the true value of the voltage is 127.43 V. Determine the

(a) Static Error (b) Static Correction

(CO3) [Knowledge]

1. A Wheatstone bridge is a circuit used to measure an unknown electrical resistance by balancing two legs of a bridge circuit. With a neat diagram explain the operation of Wheatstone bridge configuration used in D.C. circuits for measuring resistance.

(CO2) [Knowledge]

1. A Wheatstone bridge requires a change of 6 Ω in the unknown arm of the bridge to produce a change in deflection of 3 mm of the galvanometer. Determine the sensitivity and the deflection factor (CO2) [Knowledge]

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| **PART B** |
| **ANSWER ANY 5 QUESTIONS 5Q X 10M=50M** |

1. 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 (CO3) [COMPREHENSION]
2. Strain gauges are indispensable instruments in engineering, manufacturing, research and safety-critical applications, providing valuable insights into mechanical behavior, structural integrity, and material performance across a wide range of industries and disciplines. Illustrate its working principle with the necessary equations. . (CO3) [COMPREHENSION]
3. A strain gauge is a sensor used to measure strain (deformation) in an object due to an applied force or load. It operates on the principle that the electrical resistance of a conductor changes when it is stretched or compressed. A strain gauge is bonded to a beam 0.5 m long and has a cross sectional area 5 centimeter square. Young’s modulus for steel is 𝟐𝟎𝟕 𝑮𝑵/m2. The strain gauge has an unstrained resistance of 340 𝛀 and a gauge factor of 2.2. When a load is applied, the resistance of the gauge changes by 𝟎. 𝟎𝟏𝟑 𝛀. Calculate the change in the length of the steel beam and the amount of force applied to the beam (C03) [COMPREHENSION]
4. Digital voltmeters play a vital role in electrical measurement and testing across various industries, offering accuracy, precision, ease of use and versatility for a wide range of applications. Using block diagrams and detailed explanations, discuss the internal configurations and working principles of 3 digit voltmeters (CO2) [COMPREHENSION]
5. For measuring the liquid pressure during an experiment, Bourdone tube is used to convert pressure into displacement. Identify a transducer that can be used to convert the displacement into electrical signal. Explain its principle, working, characteristics, advantages, and applications with a neat sketch (CO2) [COMPREHENSION]
6. Analog to digital converter produces accurate digital output for a corresponding analog input.Main component of such ADC is control logic which resets the counter and enables the clock signal generator in order to send the clock pulses to the counter. When clock pulses are received, counter starts incrementing the signal, it pushes the switch to connect the external analog input voltage VA.This input voltage is applied to an integrator and integrator generates two different ramps, one with the known analog input voltage VA and another with a known reference voltage –Vref. Identify the type of ADC and Explain the operation and components with the neat block diagram (CO2) [COMPREHENSION]
7. 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) Explain Static characteristics of measuring instruments (CO1) [COMPREHENSION]

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| **PART C** |
| **ANSWER ANY 2 QUESTIONS 2Q X 20M=40M** |

14. 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 d and the change in the medium between the plates 𝜖r, determine the change in the capacitance with respect to the variation of the all above factors and also calculate sensitivity. (CO3) [APPLICATION]

15. 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 and it works on the principle of null deflection method (also known as the “bridge method”) to calculate an unknown inductance in a circuit. Explain the types of Maxwell's bridge, which are used to determine the self-inductance of the circuit and Compute its balanced condition.

(CO2) [APPLICATION]

16. Mustimeters are versatile electronic instruments used to measure various electrical parameters such as voltage, current, resistance, and continuity. Discuss the principles of operation with a neat diagram, highlighting their significance and applications in electrical measurements. (CO1) [APPLICATION]