Roll No												

PRESIDENCY UNIVERSITY
BENGALURU

SCHOOL OF ENGINEERING

TEST 1 - EXAMINATION

Odd Semester: 2021 - 22
Course Code: ECE 3010

Date: 25 April 2022
Time: 3:00 PM to 4:00 PM

Course Name: Measuring Instruments and Sensors
Program & Sem: B. Tech & IV Sem

Max Marks: 30
Weightage: 15%

Instructions:

(i) Read the all questions carefully and answer accordingly.
(ii) Nonprogrammable/Scientific calculators are permitted.

Part A [Memory Recall Questions]

Answer all the Questions. Each question carries 3 marks. (2Qx 3M= 6M)

1. In the process of measurement, the errors are bound to occur. If the sources of errors are known, then the efforts can be made to reduce the errors and partly to eliminate them. List the various types of errors the can present in measuring instruments. [3M] (C.O.No.1) [Knowledge level]

2. The static characteristics are defined for the instruments which measure the quantities which do not vary with time. The various static characteristics are accuracy, precision, resolution, error, sensitivity, threshold, reproducibility, zero drift, stability and linearity. Define resolution, sensitivity and hysteresis. [3M] (C.O.No.1) [Knowledge level]

Part B [Thought Provoking Questions]

Answer all the Questions. Each question carries 6 marks. (2Qx6M=12M)

3. A rotameter is a device used for flow measurement. It converts flow rate into displacement. The flow rate and rotameter readings in displacement are as follows. The manufacturer tells that it follows linear relation.

Flowrate (LPH)	0	200	400	600	1000
Rotameter reading (cm)	5	10	15	20	30

Estimate the flowrate when rotameter reading is 27 cm?

[6M](C.O.No.1)[Comprehension level]

4. **(a)** A component manufacturer constructs certain resistances to be anywhere between $\mathbf{67.5}\ \boldsymbol{k\Omega}$ and $\mathbf{82.5}\ \boldsymbol{k\Omega}$ and classifies them to be $\mathbf{75}\ \boldsymbol{k\Omega}$ resistors. Estimate the tolerance in the resistor? Identify the

color code?

(b) The following resistance values of a platinum resistance thermometer were measured at a range of temperatures.

Resistance (Ω)	256	264	272	280
Temperature (^oC)	101	126	151	176

Predict the measurement sensitivity of the instrument. [6M](C.O.No.1)[Comprehension level]

Part C [Problem Solving Questions]

Answer all the Questions. Each question carries 12 marks. (1Qx12M=12M)

5. A student wants to measure the voltage across the circular potentiometer. The readings are taken on different days so that the student can find out the static behavior of the potentiometer. The Following 10 observations are as follows in Volts (V): 41.7, 42.0, 41.8, 42.0, 42.1, 41.9, 42.0, 41.9, 42.5 and 41.8 volt. Compute the (a) arithmetic mean, (b) average deviation, (d) standard deviation and (e) variance.

[12M] (C.O.No.1) [Application Level]

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GAIN MORE KNOWLEDGE
REACH GREATER HEIGHTS

PRESIDENCY UNIVERSITY
BENGALURU
SCHOOL OF ENGINEERING
TEST 2

Winter Semester: 2021 - 22

Course Code: ECE 3010

Course Name: Measuring Instruments and sensors

Program & Sem: B.Tech & IV

Date: 31/05/2022

Time: 03:00PM – 04:00PM

Max Marks: 30

Weightage: 15%

Instructions:
(i) Read the all questions carefully and answer accordingly.
(ii) Bring your own calculator.

Part A [Memory Recall Questions]

Answer all the Questions. Each question carries THREE marks. (2Qx 3M= 6M)

Q.NO.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 (C.O.No.3) [Knowledge level]

Q.NO.2 4 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 and working.
(C.O.No.3) [Knowledge level]

Part B [Thought Provoking Questions]

Answer all the Questions. Each question carries SIX marks. (2Qx6M=12M)

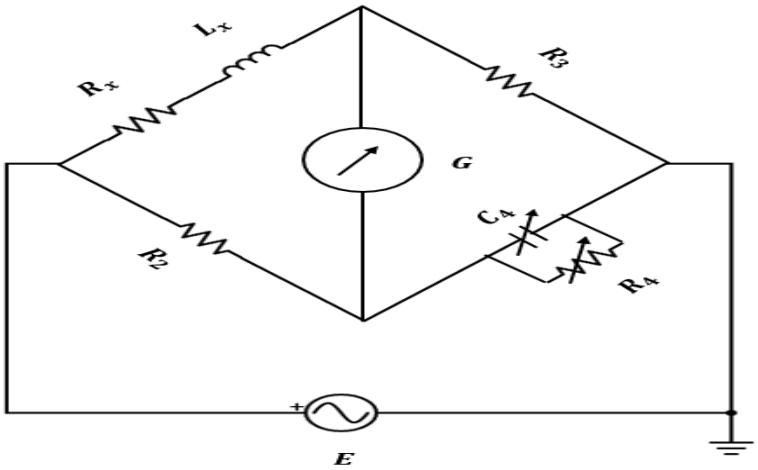
Q.NO. 3 Analog to digital converter which produces more accurate digital output for a corresponding analog input. Main component of such ADC is control logic which resets the counter and enables the clock signal generator in order to send the clock pulses to the counter. When it is received the start commanding signal, it pushes the switch sw to connect to 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 Determine the digital output of above identified ADC which is having t_1 as 83.33ms and the reference voltage as 100 mV for an input voltage of 100 mV. The clock frequency is 12 kHz.
(C.O.No.2) [Comprehension level]

Q.NO. 4 A compressive force is applied to a structural member. The strain is 5 micro – strain. Two separate gauges are attached to the structural member, one is nickel wire strain gauge having a gauge factor of -12.1 and the other is nichrome wire strain gauge having a gauge factor of 2. Determine whether resistance increases or decreases after they are strained. The resistance of both the gauges before being strained is $\mathbf{120\ \Omega}$
.
(C.O.No.3) [Comprehension level]

Part C [Problem Solving Questions]

Answer all the Questions. Each question carries TWELVE marks. (1Qx12M=12M)

Q.NO. 5. 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 in a circuit. Compute its balanced condition



(C.O.No.2) [Application level]

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PRESIDENCY UNIVERSITY
BENGALURU
SCHOOL OF MANAGEMENT
END TERM EXAMINATION

Winter Semester: 2021 - 2022

Course Code: ECE 3010

Course Name: Measuring Instruments and sensors

Program & Sem: B.Tech & IV Sem

Date: 30th June 2022

Time: 09:30 AM to 12:30 PM

Max Marks: 60

Weightage: 30%

Instructions:
(i) *Read the all questions carefully and answer accordingly.*
(ii) *Bring your own calculator.*

Part A [Memory Recall Questions]

Answer all the Questions. Each question carries FOUR marks. (3Qx 4M= 12M)

1. The sensitivity is always expressed by the manufacturers as the ratio of the magnitude of quantity being measured to the magnitude of the response. Explain how the inverse sensitivity is defined by the manufacturers with the calibration curve which describes the sensitivity and inverse sensitivity. (C.O.No.1) [Knowledge level]

2. To determine the exact magnitude of physical forces such as temperature and pressure is difficult. But, if these physical forces are converted into an electrical signal, then their values can be easily determined using a meter. Describe the active and passive characteristics of a device which is used to convert a physical force into an electrical signal so that it can be easily handled and transmitted for measurement. (C.O.No.3) [Knowledge level]

3. With a neat diagram explain the measuring instrument which calculates the unknown resistance by balancing two legs of the bridge circuit where one leg includes the component of unknown resistance. (C.O.No.2) [Knowledge level]

Part B [Thought Provoking Questions]

Answer all the Questions. Each question carries SIX marks. (3Qx6M=18M)

4. Signal conditioning circuits are used to process the output signal from sensors of a measurement system to be suitable for the next stage of operation. Identify and explain the circuits which does the following functions a) Amplification b) Change in resistance to voltage conversion c) Elimination of noise. (C.O.No 4.) [Comprehension level]

5. 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 displacement into electrical signal. With neat sketch explain its construction and working. (C.O.No 3.) [Comprehension level]

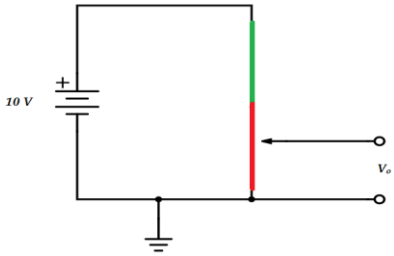
6. Differentiate the single channel and multi-channel measuring system which acts as an interface between external device and computer for acquiring signal and also for generating signal. These devices are essential in the testing of products, from automobiles to medical devices. Earlier products were tested in an unstructured, highly subjective manner. With the invention and development this systems, which could collect data from a wide variety of sensors and all subjective opinions were replaced with objective measurements. These could easily be repeated, compared, analyzed mathematically, and visualized in many ways. (C.O.No 4.) [Comprehension level]

Part C [Problem Solving Questions]

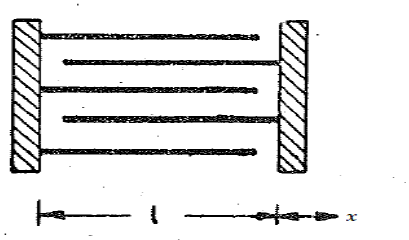
Answer all the Questions. Each question carries TEN marks. (3Qx10M=30M)

7. A potentiometer is made of wires of two materials as shown. Green is copper and red is aluminium.

Length of both wires are 50 cm. What will be the output voltage if the wiper is 70 cm from the ground? Given resistivity of Copper is $\mathbf{1.68\times10^{-8}\ \Omega m}$.
Resistivity of Aluminium is $\mathbf{2.65\times10^{-8}\ \Omega m}$.
Area of cross section is the same at $\mathbf{1mm^2}$ (C.O.No.3) [Application level]



8. Figure shows a capacitive transducer using 5 plates. The dimensions of each plates are 25 mm X25 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 8.852X10^(−12) F/m. (C.O.No.3) [Application level]



9. A barium titanate pick up has the dimensions of 5 mm X 5 mm X 1.25 mm. The force acting on it is 5 N. The charge sensitivity of barium titanate is 150 pC/N and its permittivity is $\mathbf{12.5\times10^{-9}\ F/m}$. If the modulus of elasticity ofbarium titanate is $\mathbf{12\times10^6\ N/m2}$, calculate the strain, the voltage developed, the charge and the capacitance. (C.O.No. 3) [Application level]