Roll No. | | | | | | | | | | |

ANNA UNIVERSITY (UNIVERSITY DEPARTMENTS)

B.E. /B.Tech / B. Arch (Full Time) - END SEMESTER EXAMINATIONS, APR / MAY 2025

Department of Electrical and Electronics Engineering

IV Semester

EE23403 – MEASUREMENTS AND INSTRUMENTATION

(Regulation2023)

Time:3hrs Max.Marks: 100

CO1	understand the concepts of measurement and the structural elements of various analog instruments.
CO2	Understand the principles involved in transducers and actuators.
CO3	Design the signal conditioning circuits for various transducers.
CO4	Develop interfacing circuits with the concepts of digital instrumentation
CO5	Develop the programs using PLC and virtual instrumentation for a physical system.

BL – Bloom's Taxonomy Levels

(L1-Remembering, L2-Understanding, L3-Applying, L4-Analysing, L5-Evaluating, L6-Creating)

PART- A(10x2=20Marks)

(Answer all Questions)

Q.No.	Questions	Marks	CO	BL
1	A 0-250 V voltmeter has a guaranteed accuracy of 2% of full-scale reading. The voltage measured by the voltmeter is150 volts. Determine the limiting error in percentage.	2	CO1	L2
2	Write a short note on loading effects in the measurement system	2	CO1	L2
3	What is the error that occur during the measurement of temperature using a thermocouple and how is it rectified	2	CO2	L1
4	Write the principle of pneumatic actuator	2	CO2	L1
5	A Wheatstone bridge is balanced with all the four resistances equal to 1 kW each. The bridge supply voltage is 100 V. The value of one of the resistance is changed to 1010 W. The output voltage is measured with a voltage measuring device of infinite resistance. Calculate the bridge sensitivity.	2	CO3	L2
6	The four impedances of a bridge are Z1 = 400 Ω 50°, Z2 = 200 Ω 30°, Z3 = 800 Ω –50°, Z4 = 400 Ω –40°. Find out whether the bridge is balanced under these conditions.	2	CO3	L3
7	Write a short note on the three steps involved in the conversion of analog data to digital data	2	CO4	L1
8	Why do serial bus most preferred compared to a parallel bus	2	CO4	L2
9	What type of control is replaced by PLC and list the operations that a PLC performs during the course of a scan?	2	CO5	L2
10	Differentiate between traditional and Virtual instruments	2	CO5	L1

PART- B(5x 13=65Marks)

Q.No.	Questions	Marks	CO	BL
11 (a) (i)	Discuss the static and dynamic characteristics of a measurement system	7	CO1	L3
(ii)	Briefly explain the three systems of damping generally used in analog meters	6	CO1	L3
	OR			
11 (b) (i)	The deflection torque of a moving iron instrument is unidirectional for whatever may be the polarity of the current. Explain the statement with reference to the construction and respective equation	8	CO1	L4
(ii)	A moving coil instrument has a resistance of 5 Ω and gives a full	5	CO1	L4

	scale deflection of 10 mv. Show how the instrument may be used to measure (a) voltage up to 50 v, and (b) current up to 10 A.			
12 (a) (i)	Write a brief note on inductive principle with an example	5	CO2	L3
(ii)	The resistance of a thermistor is 800 Ω at 50°C and 4 kΩ at the ice-point. Calculate the characteristic constants (A, B) for the thermistor and plot the variations in resistance between 30°C and 100°C.	8	CO2	L5
	OR			
12 (b) (i)	Discuss the method to measure flow using electromagnetic flow meter	8	CO2	L3
(ii)	Describe the functions of integrated smart sensor	5	CO2	L3
13 (a) (i)	Describe the configuration of a bridge which is used to measure low resistance and derive its equation under balanced Condition	8	CO3	L4
	Maxwell Bridge is not suitable for measurement of inductor values with high Q factor. Give reason for this statement with its respective equations	5	CO3	L4
	OR			
13 (b)	Explain the configuration and phasor diagram of Schering's bridge under balanced condition and derive the equation to measure the capacitance, dissipation factor and loss angles.	13	CO3	L4
14 (a)	Explain the method of measurement of the following parameters using CRO i) Frequency ii) Phase difference	 7 6	CO4	L3
	OR			
14 (b)(i)	Write a short note on performance characteristics of digital meters	5	CO4	L3
(ii)	Describe the method of measurement of voltage using digital meters using Dual slope Integrating technique.	8	CO4	L3
15 (a) (i)	The logical circuit in a passenger car activates a warning light F if the ignition is on (I = 1) and the driver's (D = 1) or a passenger's (P = 1) seat belt is not fastened and a pressure sensor indicates that a seat is occupied (S = 1). Find a logical expression for F and draw the logical circuit.	5	CO5	L4
(ii)	Explain the architecture of PLC with its respective components	8	CO5	L3
	OR			
15 (b) (i)	Write a PLC program to control the angle of a stepper motor	5	CO5	L4
	Develop a GUI to measure the temperature	8	CO5	L4

PART- C(1x 15=15Marks)

(Q.No.16 is compulsory)

Q.No.	Questions	Marks	CO	BL
16. (i)	The four arms of a bridge supplied from a sinusoidal source are configured as follows: Arm AB: A resistance of 100 Ω in parallel with a capacitance of 0.5 μF, Arm BC: A 200 Ω non inductive resistance, Arm CD: A 800 Ω non inductive resistance, Arm DA: A resistance Rx in series with a 1 μF capacitance. Determine the value of Rx and the frequency at which the bridge will balance.	8	CO3	L5
(ii)	An ac bridge is balanced at 2 kHz with the following components in each arm: Arm AB = 10 KΩ, Arm AB = 100 μF in series with 100 kΩ, Arm AD = 50 kΩ Find the unknown impedance R ±jX in the arm DC, if the detector is between BD.	7	CO3	L4