Roll No.												

PRESIDENCY UNIVERSITY

BENGALURU

End - Term Examinations –MAY 2025

Date: 30-05-2025 **Time:** 01.00 pm – 04:00 pm

School: SOE	**Program:** B. Tech-ECE	
Course Code: ECE3015	**Course Name:** Measuring Instruments and Sensors	
Semester: IV	**Max Marks**: 100	**Weightage**: 50%

CO - Levels	CO1	CO2	CO3	CO4	CO5
Marks	26	24	24	26	

Instructions:

(i) Read all questions carefully and answer accordingly.

(ii) Do not write anything on the question paper other than roll number.

Part A

Answer ALL the Questions. Each question carries 2marks. **10Q x 2M=20M**

1.	Define transducer with the list of various types of transducers	**2 Marks**	**L1**	**CO4**
2.	Explain any 2 static characteristics of measuring instrument	**2 Marks**	**L1**	**CO1**
3.	List the various types of errors which is found in measuring instruments	**2 Marks**	**L1**	**CO1**
4.	Write an equation to calculate Average deviation in the measurement	**2 Marks**	**L1**	**CO1**
5.	Identify a bridge that can be used to measure unknown capacitance	**2 Marks**	**L1**	**CO4**
6.	Define Gauge Factor and Modulus of Elasticity?	**2 Marks**	**L1**	**CO2**
7.	State the working principle of capacitive transducer	**2 Marks**	**L1**	**CO3**
8.	List the different methods to measure medium resistances	**2 Marks**	**L1**	**CO2**
9.	Write the balanced condition of Wheatstone bridge	**2 Marks**	**L1**	**CO3**
10.	Differentiate stress and strain	**2 Marks**	**L1**	**CO4**

Part B

Answer the Questions. **Total Marks 80M**

<table>
<tr><td>11.</td><td>a.</td><td>Six students recorded their individual weight measurements as 68 kg, 72 kg, 70 kg, 69 kg, 71 kg, and 73 kg. Compute:
(b) The deviations from the mean
(c) The average deviation
(d) The standard deviation
(e) The variance</td><td>10 Marks</td><td>L3</td><td>CO1</td></tr>
<tr><td></td><td>b.</td><td>A measuring system is designed to provide precise and dependable data about the physical value of a measured variable.
a) Explain the various measurement methods and support each with an appropriate example.
b) Describe the essential static characteristics of measuring instruments and discuss their importance in ensuring measurement accuracy.</td><td>10 Marks</td><td>L2</td><td>CO1</td></tr>
<tr><td colspan="6">Or</td></tr>
<tr><td>12.</td><td>a.</td><td>Measurements conducted in a laboratory or any other setting are always subject to errors. These errors can originate from multiple sources, making it impossible to achieve completely error-free measurements.

Categorize the different types of measurement errors and illustrate each with a relevant example</td><td>10 Marks</td><td>L2</td><td>CO1</td></tr>
<tr><td></td><td>b.</td><td>Suppose you are asked to measure a temperature and the following set of readings were obtained (in degree centigrade) using five different thermometers $(T_1, T_2, T_3, T_4, T_5)$

<table>
<tr><td>T_1</td><td>35</td><td>34</td><td>33</td><td>36</td><td>35</td><td>33</td><td>36</td><td>34</td><td>33</td><td>33</td></tr>
<tr><td>T_2</td><td>32</td><td>33</td><td>32</td><td>31</td><td>29</td><td>30</td><td>28</td><td>29</td><td>32</td><td>31</td></tr>
<tr><td>T_3</td><td>33</td><td>34</td><td>32</td><td>34</td><td>26</td><td>28</td><td>33</td><td>27</td><td>31</td><td>33</td></tr>
<tr><td>T_4</td><td>36</td><td>37</td><td>35</td><td>34</td><td>37</td><td>41</td><td>43</td><td>44</td><td>38</td><td>38</td></tr>
<tr><td>T_5</td><td>32</td><td>31</td><td>31</td><td>30</td><td>29</td><td>30</td><td>29</td><td>29</td><td>31</td><td>31</td></tr>
</table>
Based on the given data, rank the thermometers based on their precisions and accuracies by filling the tabular column. You may consider the true value to be 30°C.

<table>
<tr><td>Rank →</td><td>Rank 1</td><td>Rank 2</td><td>Rank 3</td><td>Rank 4</td><td>Rank 5</td></tr>
<tr><td>Accuracy</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Precision</td><td></td><td></td><td></td><td></td><td></td></tr>
</table>
</td><td>10 Marks</td><td>L3</td><td>CO1</td></tr>
</table>

13.	**a.**	Wheatstone Bridge stands as a cornerstone in precision resistance measurement techniques. Illustrate its construction and working principle, and discuss how achieving a balanced	**10 Marks**	**L2**	**CO2**

		bridge condition is crucial for accurately determining an unknown resistance.			
	b.	For a dual ADC Type 3.5digit 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) (0–20V) is used **(c)** (c)(0–200V) is used	10 Marks	**L3**	**CO2**
		Or			
14.	**a.**	Maxwell's Inductance Bridge is an important tool for measuring inductance. Describe its construction and operating principle, and analyze how it compares to other methods of inductance measurement in terms of accuracy and sensitivity	**10 Marks**	**L3**	**CO2**
	b.	With a neat block diagram design 3 digit Digital voltmeter(DVM)	**10 Marks**	**L2**	**CO2**

15.	**a.**	Describe the construction and working principle of a Cathode Ray Oscilloscope (CRO). How is it used to measure voltage, frequency, and phase difference of electronic signals?	**10 Marks**	**L3**	**CO3**
	b.	Find the digital output of a dual slope ADC having t_1 as 83.33ms and the reference voltage as 100Mv for an input voltage of 100mV. The clock frequency is 12kHz	5 Marks	**L2 2**	**CO3**
	c	A Wheatstone bridge has P=3.5 $k\Omega$, Q=7 $k\Omega$ and the galvanometer null is obtained when S=5.51 $k\Omega$. Calculate the value of R and Determine the resistance measurement range for the bridge if S is adjustable from 1 kΩ to 8 kΩ	5 Marks	**L**	**CO3**
		Or			
16.	**a.**	Cathode Ray Tubes (CRTs) were once the heart of display technology. Discuss the internal structure and operation of a CRT, highlighting how electron beam generation and deflection help in visualizing electrical signals	**10 Marks**	**L2**	**CO3**
	b.	Flash-Type ADCs are known for their blazing speed in analog-to-digital conversion. Describe the operation of a 3-bit Flash ADC with the help of a comparator array and encoder logic. What role does the priority encoder play, and how does it influence the overall performance?	**10 Marks**	**L3**	**CO3**

17.	**a.**	Describe the working principle of capacitive transducers using a differential arrangement. How does this configuration improve sensitivity and linearity in displacement measurement?	**10 Marks**	**L3**	**CO4**
	b.	Explain the construction, working principle, and types of Bourdon tube pressure gauges. Discuss their advantages, limitations, and typical applications in pressure measurement	**10 Marks**	**L2**	**CO4**
		Or			
18.	**a.**	Explain the working principle and construction of an LVDT, and discuss how its output varies under different core displacement conditions such as null position, positive displacement, and negative displacement	**10 Marks**	**L2**	**CO4**
	b.	A potentiometer is made of wires of two materials. Green is copper and red (from the ground) is aluminum. 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 Aluminum is $\mathbf{2.65\times10^{-8}\ \Omega m}$. Area of cross section is the same at $\mathbf{1}\boldsymbol{mm}^2$	**10 Marks**	**L3**	**CO4**