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

ANNA UNIVERSITY (UNIVERSITY DEPARTMENTS)

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

ELECTRONICS AND COMMUNICATION
VI & VIII
EC5020 MEASUREMENTS AND INSTRUMENTATION
(Regulation 2019)

Time:3hrs Max.Marks: 100

CO1	Discuss about the principles of various measurement techniques
CO2	Analyze the transducers and its impact
CO3	Explain about the signal conditioning system and signal analyzers
CO4	Illustrate the digital measurement equipments
CO5	Emphasize the need for data acquisition, recording and display systems

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 digital voltmeter has a read-out reading from 0 to 9,999 counts. Determine the resolution of the instrument in volt when the full scale reading is 9.521 V	2	1	3
2	Define measurand. Give examples of measurands from an automotive system	2	1	2
3	What is the Seebeck effect? How is it used in thermocouples?	2	2	2
4	A strain gauge with a resistance of 100 Ω experiences a resistance change of 2 Ω for a strain of 3000 microstrain. Calculate the gauge factor.	2	2	3
5	List the different types of preamplifier	2	3	2
6	What is a wave analyzer?	2	3	2
7	State the principle of working of a digital voltmeter	2	4	2
8	Mention the requirement and use of IEEE 488/GPIB protocols	2	4	2
9	Bring out the different types of graphic data recorders used in measurement systems	2	5	2
10	List the various measurement systems applied to Micro and Nanotechnology applications.	2	5	2

PART- B(5x 13=65Marks)
(Restrict to a maximum of 2 subdivisions)

Q.No	Questions	Marks	CO	BL
11 (a)	A car manufacturer claims that the fuel consumption of a car is 6.5 liters per 100 kilometers. An independent test team measures the actual fuel consumption of the car and finds that it is 6.8 liters per 100 kilometers. Calculate the absolute error and percentage error in the fuel consumption measurement. Also find the relative accuracy.	13	1	5
	OR			
11 (b)	A physicist is measuring the time it takes for a pendulum to complete 10 oscillations. The true period of the pendulum (time for one oscillation) is known to be 2.0 seconds. Over 5 trials, the physicist records the following times for 10 oscillations: 20.1s, 19.9 s, 20.2 s, 21.0 s, 19.8 s. Identify the potential errors and explain how they may have	13	1	5

	affected the measurements. Explain the occurrence of the gross error in Trial 4 and discuss how it could have impacted the accuracy of the experiment. Calculate the accuracy and precision of the measurements			
12 (a)	With a neat diagram explain the construction, working and applications of a LVDT transducer. Bring out any 3 differences with an RVDT transducer	**13**	2	3
	OR			
12 (b)	Indicate, using the relevant equations, how different temperature sensors, such as thermistor, RTD and thermocouple, operate. Draw supporting diagrams wherever applicable	**13**	2	3
13 (a)	A measurement system is used to monitor a low-frequency physiological signal, such as an ECG (0.05 Hz), which is recorded in the presence of electrical noise from power lines (50/60 Hz) and high-frequency electromagnetic interference. Choose and explain the appropriate filter type. What trade-offs would you need to consider between filter order, filter type, and system performance? Explain with appropriate diagrams	**13**	3	4
	OR			
13 (b)	Signals from high-voltage industrial equipment are measured and processed by low-voltage control systems. However, the environment is prone to heavy electrical interference, which could corrupt the signals if not properly managed. How would you select and design the isolation amplifier to ensure both signal accuracy and safety?	**13**	3	4
14 (a)	What is a Digital Voltmeter (DVM)? Discuss its construction, features, accuracy, and resolution.	**13**	4	3
	OR			
14 (b)	Explain the working principle, block diagram, and major components of an electronic frequency counter. Discuss their applications, and the factors affecting their accuracy and resolution.	**13**	4	3
15 (a)	Elucidate on the construction, working principle, modes of operation, and applications of a Dual Trace Cathode Ray Oscilloscope (CRO)	**13**	5	3
	OR			
15 (b)	Elaborate the architecture and applications of virtual instrumentation in instrumentation.	**13**	5	3

PART- C(1x 15=15Marks)

(Q.No.16 is compulsory)

Q.No	Questions	Marks	CO	BL
16.	An LVDT is used in a CNC machine to monitor tool displacement with a full-scale range of ±10 mm. The corresponding output voltage range is ±5 V. (i) If the output is linear, what displacement does +2.5 V correspond? (ii) When the tool displacement is increased from 6mm to 10 mm the output voltage increases from 3V to 5V. However when the tool displacement is decreased from 10mm to 6mm the output observed is 3.3V. Explain in detail the characteristics of measurement that gives rise to this effect. (iii) During one of the experiments, it is observe that the LVDT output is +2.5 V when the tool is expected to be at the 0 mm position. What error is observed here? (iv) If the tool can measure minimum changes of 0.1mm explain and compute sensitivity and resolution of the measurements	**4** **4** **3** **4**	1	5