K. K. Wagh Institute of Engineering Education & Research, Nashik

(An Autonomous Institute From A.Y. 2022-23)

WINTER-2025	
Exam Seat No.:	
Academic Year:2025-2026	Semester:III
Class:SY	Program:B.Tech
Branch Code:ELE	Pattern:2022
Name of Course:Measurement and Instrumentation	Course Code:ELE222003
Max. Marks:60	Duration:2.30 Hrs.

Instructions: Candidates should read carefully the instructions printed on the Question Paper and on the cover page of the Answer Book, which is provided for their use.

1. This question paper contains _02_page(s).
2. Answer to each new question is to be started on a new page.
3. Assume suitable data wherever required, but justify it.
4. Draw the neat labelled diagrams, wherever necessary.
5. The last columns indicates the Course Outcome and level of Blooms Taxonomy of the Question/sub-question.

		Marks	CO
Question No. 1			
a)	For energy metering, why are phase angle and ratio errors in CTs and PTs significant? Provide strategies to reduce them through design or construction modifications.	(6)	CO1, CO2
Question No. 2			
a)	Describe how power in a three-phase system is measured using a two-watt meter. What makes it better than other methods?	(6)	CO1, CO2
Question No. 3			
3a)	Describe the working principle of an AC bridge network employed for precise frequency determination using a combination of resistive and capacitive arms. Draw the circuit diagram and derive the condition for balance and frequency equation.	(8)	CO2, CO4
	OR		
3b)	Explain how an instrument employing a hand-driven generator and rectifier arrangement can be used to measure earth resistance accurately. Draw the suitable Diagram and describe the sequence of operation.	(8)	CO2, CO4
3c)	A Maxwell's Inductance capacitance bridge is to measure inductance by comparison with capacitance. The various values at balance are: R2=500 Ω, R3==700 Ω, R4=1200 Ω, C4=0.7μF. Calculate Value of R1 & L1. Calculate also the storage factor of coil if frequency is 900Hz	(8)	CO4
	OR		
3d)	A sheet of Bakelite 3.5mm thick is tested at 60A sheet of Bakelite 3.5mm thick is tested at 60Hz between 0.13m in a diameter. The schering bridge employs a standard air capacitor C2 of 105μF capacitance, a non reactive resistance R4 of 1100/ΠΩ in parallel with a variable capacitor C4=0.7 μF, and a nonreactive variable resistance R3. Balance obtained with C4=0.7 μF and R3=260Ω. Calculate the capacitance, power factor and relative permittivity of sheet.Hz between 0.13m in a diameter. The schering bridge employs a	(8)	CO4

standard air capacitor C2 of 105μF capacitance, a non reactive resistance R4 of 1100/ΠΩ in parallel with a variable capacitor C4=0.7 μF, and a nonreactive variable resistance R3.

Balance obtained with C4=0.7 μF and R3=260Ω. Calculate the capacitance, power factor and relative permittivity of sheet.

Question No. 4

4a)	Explain how a data acquisition system serves as a vital link between real-world physical quantities and digital control or analysis platforms. Discuss its functional significance, working principle, and importance in modern instrumentation and automation.	(8)	CO1, CO2

OR

4b)	How do amplification and sample-and-hold circuits contribute to accurate signal conditioning in data acquisition systems? Explain their combined role with a neat block diagram.	(8)	CO1, CO2
4c)	With a neat block diagram, explain the operation of a modern digital multimeter for measuring AC and DC quantities. How does the instrument ensure accuracy, reliability in industrial applications	(8)	CO2, CO3

OR

4d)	With a neat diagram, explain the calibration setup for a single-phase static energy meter using three-phase supply. How are voltage, current, and power measurements used to adjust the meter reading?	(8)	CO2, CO3

Question No. 5

5a)	With the help of a neat diagram, explain how a rotary potentiometer can be used to measure angular displacement. Derive the relationship between output voltage and angular rotation.	(8)	CO3, CO4

OR

5b)	Explain the construction and working principle of a Pirani gauge with a neat labeled diagram. Why does its operation depend on the thermal conductivity of the gas, and how is it affected by gas pressure and gas type?	(8)	CO3, CO4
5c)	Explain the construction and working principle of the Sight Tube (Sight Glass) Level Measurement Method. Why does it work only when the liquid in the tank and tube are under the same pressure conditions?	(8)	CO2, CO4

OR

5d)	Smart Sensors are transforming automation and intelligent monitoring systems. Discuss various any 4 types of Smart Sensors with their working principles and real-life applications.	(8)	CO2, CO4

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