



**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:2023
Name of Course:Measurement and Instrumentation	Course Code:2306202
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) 1, 2

**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) 1, 2

**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) 2, 4

**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) 2, 4

- 3c) A Maxwell's Inductance capacitance bridge is to measure inductance by comparison with capacitance. The various values at balance are: (8) 4

$R_2=500 \Omega$ ,  $R_3=700 \Omega$ ,  $R_4=1200 \Omega$ ,  $C_4=0.7 \mu F$ . Calculate Value of  $R_1$  &  $L_1$ . Calculate also the storage factor of coil if frequency is 900Hz

**OR**

- 3d) A sheet of Bakelite 3.5mm thick is tested at 60Hz between 0.13m in a diameter. The schering bridge employs a standard air capacitor  $C_2$  of  $105 \mu F$  capacitance, a non reactive resistance  $R_4$  of  $1100/\pi \Omega$  in parallel with a variable capacitor  $C_4=0.7 \mu F$ , and a nonreactive variable resistance  $R_3$ . (8) 4

Balance obtained with  $C_4=0.7 \mu F$  and  $R_3=260 \Omega$ . 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) 1, 2

**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) 1, 2
- 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) 2, 3

**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) 2, 3

**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) 3, 4

**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) 3, 4
- 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) 2, 4

**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) 2, 4

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