

INSTRUMENTATION AND SENSORS FOR CIVIL ENGINEERING APPLICATIONS

QUESTION BANK

UNIT 1

1. Draw the basic block diagram of PMMC, explain its components & derive the torque equation?
2. Describe use multiplier & shunts for extension of range of basic PMMC meter?
3. Explain various methods of providing damping torque in an indicating instrument
4. Explain the working of attraction type and repulsion type moving iron instruments with neat diagrams.
5. Mention the need for Kelvins Double bridge and derive the balance equation?
6. Derive the bridge balance condition for the Maxwell bridge & Schering bridge.
7. Compare and contrast Moving coil and Moving Iron Instruments?
8. Draw the block diagram showing the basic functional elements of instrument and explain the functions of each.

UNIT II

1. What is a Load cell? List out the different types of Load cells and explain any one in detail?
2. Explain the working of the most preferred Load cell for measuring loads in rock bolts, cable anchors and tendons, & structural beams?
3. Explain the principle and working of Photoelectric transducers?
4. Explain the internal structure of CRT and describe the principle of electrostatic focusing
5. What is an XY recorders? How do you distinguish is from Xt and Yt recorders?
6. List out the different types of Stylus Pens and their requirements to be used with strip chart recorders?
7. Explain the selection criteria for the transducers.
8. Explain with a neat diagram the working of LVDT? Mention its merits and Demerits?

UNIT III

1. Discuss the need for vibration measurements in Bridges?
2. What is an Accelerometer? Explain the working of Piezoelectric accelerometer with a neat diagram?
3. Draw the block diagram of digital frequency meter and explain its operation?
4. Draw and analyze the Mass - spring – dashpot model for displacement & acceleration measurements?
5. Analyze the underlying working principle of Drag Cup type tachometer?
6. Discuss how hall effect sensors can be used for speed measurement?
7. Mention the parameters that quantify surface roughness? Explain the stylus method for measuring roughness profile?
8. Differentiate Incremental and absolute optical encoders?

UNIT IV

1. Discuss with a neat block diagram the need and instrumentation for Flue gas analysis using Orsat Apparatus?
2. Mention the common pollutants obtained from vehicle emission? List out the methods available for detection of them?
3. Explain the working of NDIR analyzers for detection of CO & CO₂?
4. Discuss the role of Temperature in separation of compounds using Gas Chromatography?
5. Draw and explain the underlying principle of Saybolt Viscometer?
6. Discuss the need for Ultrasonic Level sensor? Mention its applications?
7. Mention why Viscosity measurement is required in Structural Engineering? Explain the significance of capillary tube viscometer?
8. Mention the merits and demerits of Capacitance type liquid gauge?

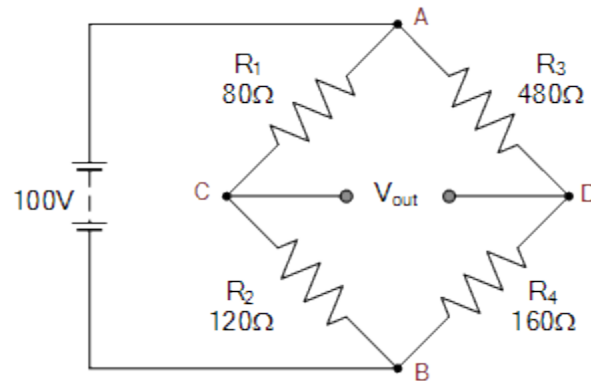
UNIT V

1. List out the steps to choose the Right flow meter for your application?
2. Differentiate Volumetric and mass flow measurement?
3. Mention the types of Ultrasonic flowmeters? Explain any one of them?
4. Explain the working of Electromagnetic flow meter?
5. Mention the merits and demerits of Lobed Impellor type flowmeter?
6. Discuss the working principle of Turbine type flow meter?
7. What is a Rotating Vane flowmeter? Explain its applications in Industries?

CHALLENGES

1. If PMMC meter have internal resistance of 10Ω and full-scale range of 1mA. If we want to increase the meter range to 1A what should be the value of shunt resistance?
2. Design a multirange ammeter to give the following ranges 10mA, 100mA, 1A, 10A, and 100A. If d'Arsonval meter have internal resistance of 10Ω and full-scale current of 1mA? What are the values of shunt resistances required?
3. We have a micro ammeter and we wish to adapted it so as to measure 1-volt full scale, the meter has internal resistance of 100Ω and Full scale current of $100\mu\text{A}$. What is the value of Series Resistance?
4. A basic d'Arsonval movement with internal resistance of 100Ω and half scale current deflection of 0.5 mA is to be converted into a multirange d.c voltmeter with voltages ranges of 10V, 50V, 250V, and 500V. What are the values of series resistances required?
5. A PMMC ammeter has the following specification Coil dimension are $1\text{cm} \times 1\text{cm}$. Spring constant is $0.15 \times 10^{-6} \text{ N m / rad}$; Flux density is $1.5 \times 10^{-3} \text{ wb / m}^2$. Determine the no. of turns required to produce a deflection of 900 when a current 2mA flows through the coil

6. Calculate the output voltage across points C and D and the value of resistor R_4 required to balance the bridge circuit.



7. The resistance of a Strain gauge sensor used in Beam load measurement is initially 200Ω. Whenever the load is applied to the beam, strain gauge sensor senses the strain. For 1 Kg weight the resistance increases by 10Ω. When the above system is used for measurement of 100Kg load, obtain the out of balance voltage for the resistance increase by using Wheat stone bridge?