



**Subject Name:** Instrumentation and control system

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**Year and Sem, Department:** IV/I, Mechanical Engineering.

**Unit-I: BASIC PRINCIPLES OF MEASUREMENT ,MEASUREMENT OF DISPLACEMENT**

**Important points / Definitions:**

1. Introduction
2. Definition of measurement: Comparison process of unknown value with the known value.
3. Measurement systems Generalized configuration and functional descriptions of measuring instruments examples
4. Dynamic performance characteristics: Speed of response, Measuring lag ,Fidelity, Dynamic error, Dead time.
5. Error: Difference between Standard value to the indicated value
6. Sources of error, classification and elimination of errors: Systematic errors, Environmental errors, Observational errors.
7. Theory and construction of transducers to measurement of Displacement Piezo electric
8. Inductive transducers :Works on principle of mutual induction
9. Capacitance, Resistance transducers: Change in dimensions of the conducting material gives change in electrical properties.
10. Ionization and photo electric transducers

**Short Questions :**

1. Distinguish between Accuracy and Precision.(Nov 2016)
2. What is the role of Manipulation elements of measuring Instrument? (Mar 2017)
3. State and explain briefly desirable and undesirable dynamic characteristics. (Nov 2016)
4. List out active transducers. (Nov 2016)
5. Define Resolution and Threshold.(Nov 2017)
6. How errors are classified. Enumerate the various sources of errors. (Nov 2017)
7. What are the environmental factors on the design of measuring instruments? (Apr 2018)
8. What is the need for calibration of measuring instruments? (Apr 2018)
9. State the two differences between the basic and auxiliary functional elements of measurement system (Apr 2018)
10. State the advantages of electric transducers over mechanical transducers. (Apr 2018)
11. Explain why it is desirable to use that piezo electric transducers should be used for measuring of dynamic quantities only(Apr 2018)



12. Define measurement and explain its significance in our day to day life. (Apr 2018)
13. What is meant by statistical analysis of random errors? (Apr 2018)

**Long Questions**

1. Draw the generalized scheme of a typical measurement system and explain about various components of it.(Nov 2016)
2. State and explain various types of errors in measurement instruments. .(Nov 2016)
3. Explain the construction and principle of LVDT with a neat diagram and compare with capacity pick up transducer.(Nov 2016)
4. Describe the terms Linearity , Repeatability, Calibration, Sensitivity, Range and span.(Apr 2017)
5. Explain the use of Piezo electric transducers.(Apr 2018)
6. Explain the basic principles of measurement. .(Nov 2018)
7. State and explain the Dynamic Characteristics of a measurement system. (Nov 2018)
8. Explain the construction and working principle and advantages of capacitive transducers .(Nov 2018)

**Fill in the Blanks / Choose the Best:**

1. Closeness of measured value to true value is Accuracy
2. Transducer device is used to convert one form of energy into another form energy
3. Systematic errors that occur due to the use of improper procedures.
4. Capacitance transducer is used to measure for Angular displacement
5. Inductive transducer is used for measurement of physical quantities. ( A )
  - a) True
  - b) False
6. Which of following represent active transducer? ( C )
  - a) Strain gauge
  - b) Thermistor
  - c) LVDT
  - d) Thermocouple
7. What is the principle of operation of LVDT? ( A )
  - a) Mutual inductance
  - b) Self-inductance
  - c) Permanence
  - d) Reluctance
8. . Which of the following can be measured using Piezo-electric transducer? ( C )
  - a) Velocity
  - b) Displacement
  - c) Force
  - d) Sound
9. In a measuring system quantity under measurement is termed as \_\_\_\_\_ ( A )
  - a) Measurand
  - b) Controllers
  - c) Sensors
  - d) Indicators



**Unit-II: Measurement of Temperature, Measurement of Pressure:**

**Important points / Definitions:**

1. Temperature: Sensing of hotness or coolness
2. Temperature Scales:  $^{\circ}\text{C}$ , Kelvin, Foreign heat.
3. Ranges of thermometers Expansion thermometers
4. Electrical resistance thermometer: When the temperature increases the resistance of the conductor also increases.
5. Thermistor: When the temperature increases the resistance of the conductor also decreases
6. Thermocouple: Two dissimilar metals have to be joined together and two ends of the wire should maintain different temperatures.
7. Pyrometers :It works on radiation emitting particles and we can measure high temperatures with this device.
8. **Pressure:** Force applying on a unit area
9. Units, Classification of pressure measurement systems
10. Different type of Manometers
11. Piston Bourdon Pressure gauges Bellows
12. Diaphragm gauges
13. Introduction to low pressure measurement systems
14. Thermal conductivity gauges
15. Ionization pressure gauges
16. McLeod pressure gauge

**Short Questions :**

1. State the characteristics of manometric fluid.(Nov 2016)
2. Give the classification of measurement pressure(Mar 2017)
3. Explain the working principle of manometers(Mar 2017)
4. State the difference between the thermometer and thermistor.(Nov 2017)
5. Describe the constructional details of and applications of Diaphragm gauges.(Nov 2017)

**Long Questions**

1. a) Explain the temperature measurement by thermocouples.(Nov 2016)  
b) Explain the temperature measurement by resistance thermometers.
2. List electrical transducers for measurement of linear and angular displacement. And Explain the construction and working of a photo-electric transducer. .(Nov 2016)
3. Explain the principle of working of a pyrometer. With the help of a neat sketch, explain a pyrometer and state its advantages of the same. (Mar 2017)
4. a) Explain the working principle of diaphragm gauge with a neat diagram.  
b) State the advantages and disadvantages of diaphragm gauge. (Mar 2017)
5. With the help of a suitable diagram, explain the construction, working and principle features of bourdon tube pressure gauge. (Nov 2017)
6. How do you measure the pressure with the help of U-tube manometer and micro-manometer? (Nov 2017)



7. a) Explain absolute, gauge and vacuum pressure  
b) Explain with the help of suitable sketches, the difference between a Bellow gauge and a diaphragm gauge for pressure measurement. (Apr 2018)
8. Explain the construction and working principle of Ionization pressure gauge. (Apr 2018)

**Fill in the Blanks / Choose the Best:**

1. In a Wheatstone bridge Galvanometer is used as null detector.
2. The resistance of the conductor is depends on length and temperature
3. When the liquids, gases are heated they expand
4. Thermocouple is formed by two different metals which are connected at two junctions
5. Output of a bimetallic element will be Temperature
6. Which of the following can be used for measuring temperature? ( B )
  - a) Metallic diaphragm
  - b) Fluid expansion system
  - c) Capsule
  - d) Bourdon tube
7. Which of the following is used as indication instrument in fluid expansion system? ( D )
  - a) Bellows
  - b) Bourdon tube
  - c) Ammeter
  - d) Thermometer
8. Which of the following is true for bimetallic type thermometer? ( B )
  - a) Two metals have same temperature coefficients
  - b) Two metals have different temperature coefficient
  - c) One metal is cooled always
  - d) None of the mentioned
9. Convert a temperature measurement of 250 deg C into Kelvin. ( A )
  - (A) 523.2 K
  - (B) -209.7 K
  - (C) 709.7 K
  - (D) -23.2 K
10. In closed container type level measuring system, pressure at top of container is due to \_\_\_\_\_ ( A )
  - a) Vacuum pressure
  - b) Vapor pressure
  - c) Liquid pressure
  - d) Atmospheric pressure



**Unit-III: Measurement of Level, Flow measurement, Measurement of Speed, Measurement of Acceleration and Vibration**

**Important points / Definitions:**

1. Introduction to level measurements: Height of a liquid from datum line is called Level.
2. Direct and Indirect methods Capacitive
3. Ultrasonic level, Magnetic Indicators .
4. Cryogenic fuel level indicators Bubbler level Indicators
5. Rota meter
6. Magnetic, Ultrasonic flow meters
7. Turbine flow meter Hot-wire anemometer
8. Radio Doppler Anemometer(LDA)
9. Speed: The rate of change of distance with respect to time is called speed.
10. Mechanical Tachometers
11. Introduction to electrical Tachometers
12. Strobe scope Non contact type of tachometers
13. Different simple instruments, principles of Seismic instruments
14. Vibrometer and Accelerometer using this principle

**Short Questions :**

1. List out electrical tachometers (Mar 2017)
2. What is the relation ship between rotational speed and the flashing rate of stroboscope directed onto a single radial mark on the rotating wheel. .(Nov 2016)
3. Explain the principle of hot wire anemometer. (Mar 2017)
4. State the principle of level indicator.(Nov 2017)
5. What is a turbine flow meter (Nov 2017)
6. Define absolute humidity (Nov 2017)
7. List out the applications of magnetic level measurement(Apr 2018)
8. Explain the limitations of non contact type tachometers. (Apr 2018)
9. State the two advantages and limitations of rotameter(Nov 2018)

**Long Questions**

1. What is the principle of working of a magnetic flow meter? What are its advantages over other types of flow meters? (Mar 2017)
2. a) Explain the working principle of ultrasonic flow meter. .(Nov 2017)  
b) Explain the construction and working principle of turbine flow meter with a neat sketch. State its advantages and limitations. .(Nov 2017)
3. Explain in detail with neat sketches:
  - a) Bubbler level indicator
  - b) Ultrasonic level method
  - c) Capacitive level method(Mar 2017)
4. Explain the principle of operation of Hot wire anemometer(Mar 2017)
5. What is the working principle of stroboscope? Explain its working and applications.



(Nov 2017)

6. Name the different mechanical tachometers. Sketch and explain the working of centrifugal tachometer. (Nov 2017)
7. Name the different mechanical tachometers. Sketch and explain the working of centrifugal tachometer. (Nov 2018)
8. Explain the measurement of vibration by Reed Vibrometer. (Nov 2018)

**Fill in the Blanks / Choose the Best:**

1. Height of a liquid from reference datum is Level
2. Load cells are used for measuring Slowly moving weights
3. Force is a vector quantity
4. Magnetic flow meter works on the principle of Faraday's law of induction
5. The device which is used to measure the angular speed Tachometer
6. In a strobe scope Flash frequency is the measurement of speed .
7. In a Wheatstone bridge, which of the following is used as null detector? ( B )
  - a) Ammeter
  - b) Galvanometer
  - c) Voltmeter
  - d) Wattmeter
8. Which of the following represents obstruction type flow measuring systems? ( C )
  - a) Centrifugal force type
  - b) Rotating vane system
  - c) Flow nozzle device
  - d) None of the mentioned
9. Which of the following device can be used for force measurement? ( A )
  - a) Beams
  - b) Bellows
  - c) Capsule
  - d) Bourdon tube
10. Which of the following arrangements are used in load cells? ( C )
  - a) Tensile strain gauges
  - b) Compressive strain gauges
  - c) Both tensile and compressive strain gauges
  - d) None of the mentioned



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