

ICH301SENSORSANDTRANSDUCERS

UNIT I

MultiChoice Questions.

1. Bourdontubeisaprimaryelementtosense

- A. Force
- B. Displacement
- C. Distance
- D.Pressure

Answer:D

2. Helicalbourdontubeisusedtomeasure

- A. highpressure
- B. lowpressure
- C. moderatepressure
- D. verylowpressure

Answer:A

3. TheresistanceofLDRindarknessis

- A.10Megaohms
- B.1Megaohms
- C.100Mega ohms
- D.500 Meg ohms

Answer:B

4. Inpressuremeasurementbourdontubeactsas

- A.Primary transducer
- B.Secondarytransducer
- C.Sensor
- D.Sensingelement

Answer:A

5. Inconveyorbeltwhichsensorisused

- A. LDR
- B. Magnetic sensor
- C.Proximitysensor
- D.Pressure sensor

Answer :C

6. In hooke's law 'k' refers to

- A. force
- B. displacement
- C. spring constant
- D. pressure

Answer: C

7. LDR stands for

- A. Light Dependent Resistance
- B. Light Detective Resistor
- C. Light Dependent Resistor
- D. Light Dependent Reactance

Answer: C

8. Among the following which is not a pressure sensor

- A. Bourdon tube
- B. Bimetallic strip
- C. Diaphragm
- D. Pressure gauge

Answer: B

9. The range of operation of bimetallic strips is

- A. -75°C to 540°C
- B. -80°C to 780°C
- C. -70°C to 540°C
- D. -75°C to 530°C

Answer: A

10. RTD is otherwise known as

- A. resistance thermometer
- B. resistance temperature
- C. resistive thermometer
- D. resistive temperature

Answer: A

11. The range of operation of platinum RTD is

- A. 0°C to 180°C
- B. -260°C to 110°C
- C. -200°C to 1000°C
- D. 0° to 120°C

Answer: B

12. Strain gauge operates on the principle of

- A. Seebeck effect
- B. piezo-electric effect
- C. piezo-resistive effect
- D. Seebeck effect

Answer: C

13. Strain gauge is a

- A. inductive transducer
- B. capacitive transducer
- C. resistive transducer
- D. temperature transducer

Answer: C

14. Piezoelectric transducer is an example of

- A. Passive transducer
- B. Active transducer
- C. Primary transducer
- D. Temperature transducer

Answer: B

15. The range of operation of copper RTD is

- A. -200°C to 1000°C
- B. -260°C to 110°C
- C. 0°C to 180°C
- D. 0°C to 110°C

Answer: C

16. What is the main function of a proximity sensor?

- A. Measure temperature
- B. Detect the presence or absence of an object
- C. Measure pressure
- D. Detect color

Answer: B

17. Which of the following is not a type of proximity sensor?

- A. Inductive sensor
- B. Capacitive sensor
- C. Thermocouple
- D. Ultrasonic sensor

Answer: C

18. In a pressure gauge, the diaphragm deflects when:

- A. Voltage is applied
- B. Pressure difference occurs across its surfaces
- C. Temperature increases
- D. Magnetic field changes

Answer: B

19. The diaphragm in a pressure sensor converts pressure into:

- A. Electrical signal directly
- B. Mechanical displacement
- C. Temperature change
- D. Magnetic field

Answer: B

20. In industrial automation, proximity sensors are widely used for:

- A) Object counting
- B) Temperature control
- C) Voltage regulation
- D) Power generation

Answer: A

21. The output of an LVDT is

- A. Current
- B. Voltage
- C. Temperature
- D. Pressure

Correct Answer: B

22. Bellows are primarily used for measuring:

- A. Temperature
- B. Pressure
- C. Voltage
- D. Flow Rate

Answer: B

23. Bellows convert pressure into

- A. Thermal energy
- B. Mechanical displacement
- C. Electrical energy directly
- D. Magnetic flux

Answer: B

24. The working principle of a Bourdon tube is based on

- A. Change in capacitance
- B. Elastic deformation due to pressure
- C. Electromagnetic induction
- D. Piezoelectric effect

Answer: B

25. The operating principle of an LDR is based on

- A. Piezoelectric effect
- B. Hall effect
- C. Photoconductive effect
- D. Thermoelectric effect

Answer: C

Analytical type Questions

26. Why is an LDR suitable for automatically switching ON a street light at night?

- A. Its resistance increases in darkness
- B. Its resistance decreases in darkness
- C. It produces light
- D. It stores electrical energy

Answer: A

27. If a metal object moves closer to an inductive proximity sensor, what happens to its output?

- A. It detects the object
- B. It stops working
- C. Its sensitivity becomes zero
- D. It produces light

Answer: A

28. Why is a proximity sensor preferred over a mechanical switch for detecting objects?

- A. It requires physical contact
- B. It detects objects without contact
- C. It stores energy
- D. It increases object speed

Answer: B

29. If the pressure inside a Bourdon tube increases, what happens to the tube?

- A. It straightens slightly
- B. It contracts completely
- C. It remains unchanged
- D. It breaks immediately

Answer: A

30. Why does a Bourdon tube move when fluid pressure is applied inside it?

- A. Its curved cross-section tends to become circular
- B. Its temperature decreases
- C. Its mass increases
- D. Its length becomes zero

Answer: A

Descriptive Type Questions

1. a) Explain the working of proximity sensor with its applications
b) Explain the working principle of LDR with its characteristic curve.
2. Explain Bimetallic Strip with its advantages and disadvantages.
3. a) Explain C-Type Bourdon tube with neat diagram,
b) With neat diagram explain the measurement of pressure with Bourdon tube and LVDT
4. With neat diagram explain Bellows in detail.

Analytical type question

1. (i) Assertion and Reason type question (2)

Assertion (A): The resistance of a Light Dependent Resistor (LDR) decreases as the intensity of light falling on it increases.

Reason (R): Higher light intensity liberates more free charge carriers (electrons and holes) in the semiconductor material of the LDR, which increases its conductivity. [

Options

- (a) Both (A) and (R) are true, and (R) is the correct explanation of (A).
- (b) Both (A) and (R) are true, but (R) is not the correct explanation of (A).
- (c) (A) is true, but (R) is false.
- (d) Both (A) and (R) are false.

Correct Answer

- (a) Both (A) and (R) are true, and (R) is the correct explanation of (A).

(ii) Identify the device. (2)

It works on the principle of photoconductivity, whenever the light falls on it, then resistance decreases. When it is kept in the dark place, its resistance is high.

Answer : LDR.

(iii) Select the two correct statements (2)

- a. Proximity sensors are used in conveyors.
- b. The unit of temperature is Farad
- c. Bellows are used for measurement of pressure
- d. Helical bourdon tubes are not able to measure high pressure
- e. Stainless steel bourdon tube is used for low pressure applications.

Answer: a) and c)

iv) Arrange the steps in correct order related to the working of bourdon tube and LVDT in measurement of pressure.(2)

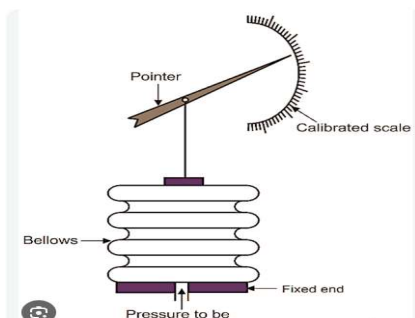
- a. The core of the LVDT moves inside the transformer coils.
- b. Fluid pressure enters the open end of the Bourdon tube.
- c. The mechanical displacement of the tube tip pushes or pulls the attached LVDT core.
- d. An electrical output voltage is generated, which is proportional to the input pressure.
- e. The C-shaped Bourdon tube tries to straighten out, causing its closed tip to move.
- f. An unbalance in the magnetic coupling creates a differential AC voltage across the secondary coils.

Answer(b) → (e) → (c) → (a) → (f) → (d)

v) Read the working principle and draw the diagram of corresponding element.(2)

When pressure is applied at one end of the element, the applied pressure will expand the element, thus the resulting movement of element moves the pointer on a calibrated scale, which shows the value of pressure.

Answer:



UNIT II

MultiChoice Questions.

1. **What is the principle behind RTDs?**
A. Change in inductance with temperature
B. Change in resistance with temperature
C. Change in capacitance with temperature
D. Change in voltage with temperature

Answer: B

2. **Which material is most commonly used in RTDs?**
A. Copper
B. Nickel
C. Platinum
D. Iron

Answer: C

3. **RTDs are generally used to measure**
A. Pressure
B. Voltage
C. Temperature
D. Humidity

Answer: C

4. **What is the typical resistance of a PT100 RTD at 0°C?**
A. 10 Ω
B. 100 Ω
C. 1000 Ω
D. 500 Ω

Answer: B

5. **RTDs are preferred over thermocouples for**
A. High temperature range
B. Low cost
C. Better accuracy and stability
D. Faster response

Answer: C

6. **What type of relationship exists between temperature and resistance in RTDs?**
A. Exponential
B. Linear (approximately)
C. Logarithmic
D. Inverse

Answer: B

7. **The RTD output is typically measured using**
A. Thermistor circuit
B. Wheatstone bridge
C. Op-amp comparator
D. Zener diode

Answer: B

8. Which of the following is NOT a common RTD configuration?

- A. 2-wire
- B. 3-wire
- C. 4-wire
- D. 5-wire

Answer: D

9. In a 3-wire RTD, the third wire is used to

- A. Increase resistance
- B. Provide shielding
- C. Compensate lead wire resistance
- D. Add voltage gain

Answer: C

10. Which of the following causes an error in RTD readings?

- A. Self-heating
- B. Parasitic capacitance
- C. Ambient pressure
- D. Oscillation Frequency

Answer: A

11. What is the working principle of a thermocouple?

- A. Change in resistance with temperature
- B. Seebeck effect
- C. Peltier effect
- D. Joule heating

Answer: B

12. A thermocouple is used to measure

- A. Pressure
- B. Temperature
- C. Humidity
- D. Voltage

Answer: B

13. Which of the following is a common type of thermocouple?

- A. Type X
- B. Type Z
- C. Type K
- D. Type R

Answer: C

14. Thermocouples generate

- A. Alternating current
- B. Resistance change
- C. Small voltage
- D. Large current

Answer: C

15. The two metals used in a Type K thermocouple are

- A. Copper and Iron
- B. Chromel and Alumel
- C. Platinum and Rhodium
- D. Nickel and Silver

Answer: B

16. The EMF produced by a thermocouple depends on

- A. Pressure and humidity
- B. Temperature difference and material pair
- C. Resistance and capacitance
- D. Voltage supply

Answer: B

17. A thermistor is a type of

- A. Capacitor
- B. Resistor
- C. Transistor
- D. Inductor

Answer: B

18. The resistance of a thermistor changes with

- A. Pressure
- B. Humidity
- C. Temperature
- D. Voltage

Answer: C

19. A thermistor whose resistance decreases as temperature increases is called a:

- A. PTC thermistor
- B. NTC thermistor
- C. Linear resistor
- D. Zener resistor

Answer: B

20. PTC stands for

- A. Positive Temperature Coefficient
- B. Passive Temperature Component
- C. Power Transfer Control
- D. Positive Thermal Connection

Answer: A.

21. NTC thermistors are commonly used for:

- A. Temperature measurement
- B. Current amplification
- C. Signal modulation
- D. Energy storage

Answer: A.

22. In an NTC thermistor, when temperature increases, resistance:

- A. Increases
- B. Decreases
- C. Remains constant
- D. First increases then decreases

Answer: B.

23. The J type thermocouple comes under which type of material?

- A. Iron- Constantan
- B. Copper-Constantan
- C. Chromel-Alumel
- D. Chromel- Constantan

Answer : A

24. The K type thermocouple comes under which type of material?

- A. Iron- Constantan
- B. Copper-Constantan
- C. Chromel-Alumel
- D. Chromel- Constantan

Answer : C

25. The T type thermocouple comes under which type of material?

- A. Iron- Constantan
- B. Copper-Constantan
- C. Chromel-Alumel
- D. Chromel- Constantan

Answer : B

Analytical type Questions

26. If the temperature of a platinum RTD increases, what happens to its resistance?

- A. Increases
- B. Decreases
- C. Remains constant
- D. Becomes zero

Answer: A

27. If the resistance of a platinum RTD increases from 100 Ω to 110 Ω , what does this indicate?

- A. Temperature has increased
- B. Temperature has decreased
- C. Pressure has increased
- D. The RTD has stopped working

Answer: A

28. The temperature coefficient of platinum RTD(PT100)

- A. 0.00386/ $^{\circ}\text{C}$
- B. 0.00385/ $^{\circ}\text{C}$
- C. 0.00384/ $^{\circ}\text{C}$
- D. 0.00383/ $^{\circ}\text{C}$

Answer : B

29. If the temperature difference between the hot and cold junctions of a thermocouple increases, what happens to the output voltage?

- A. Increases
- B. Decreases
- C. Remains zero
- D. Becomes constant

Answer: A

30. Why does a thermocouple generate an electrical voltage when its two junctions are at different temperatures?

- A. Due to the Seebeck effect
- B. Due to the Hall effect
- C. Due to electromagnetic induction
- D. Due to resistance heating

Answer: A

Descriptive Type Questions

1. With neat diagram and characteristic curve, explain RTD in detail.
2. Explain working principle of thermocouple in detail.
3. Explain in detail about the classification of transducers.
4. Explain the construction and working principle of thermistor with its applications.

Analytical type question

1. (i) Assertion and Reason type question

(2)

Assertion (A): RTDs are preferred over thermistors for highly accurate temperature monitoring across wide industrial temperature ranges (e.g., -200°C to 650°C).

Reason (R): Thermistors exhibit a highly linear relationship between resistance and temperature over their entire operating range compared to the slightly curved relationship of platinum RTDs.

Options:

- (a) Both (A) and (R) are true, and (R) is the correct explanation of (A).
- (b) Both (A) and (R) are true, but (R) is *not* the correct explanation of (A).
- (c) (A) is true, but (R) is false.
- (d) Both (A) and (R) are false.

Answer:(c)(A) is true, but (R) is false.

(ii) Identify the device.

(2)

It is also called a thermal resistors. It exhibits negative temperature co-efficient. It exhibits non-linear characteristics of resistance Vs temperature .

Answer : Thermistor

(iii) Select the two correct statements

(2)

- a) The common value for platinum RTS is 100 Ω at 0°C
- b) The characteristics of thermistor is linear
- c) The characteristics of platinum RTD is nonlinear.
- d) Thermocouple works on the principle of Hall Effect.
- e) RTD is also called as Resistance Thermometer.

Answer: a) and e)

(iv) Arrange the steps in correct order related to the working of POT in measurement of displacement.

(2)

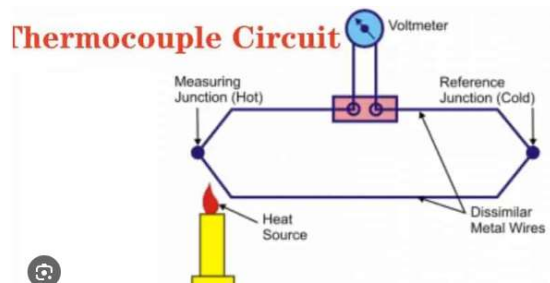
- a) The sliding contact (wiper) moves along the resistive element track.
- b) A stable external DC or AC voltage is applied across the two fixed end terminals of the potentiometer.
- c) An external mechanical force moves the object whose displacement needs to be measured.

- d) The change in electrical resistance alters the output voltage collected between the moving wiper and one fixed terminal.
- e) The moving object, physically connected to the potentiometer's shaft, drives the wiper.
- f) The electrical length of the resistive track between the wiper and the reference end terminal changes.

Answer: b) → c) → e) → a) → f) → d)

v) Read the working principle and draw the diagram of corresponding transducer (2)

When two dissimilar metals are joined together forming two junctions, an emf will exist between the junctions. The emf generated depends on the temperature difference between the junctions.



UNIT III

MultiChoice Questions.

1. Self inductance of the coil is inversely proportional to

- A. Flux path through air
- B. Length of the air gap
- C. Reluctance of the air gap
- D. Number of turns

Answer: B.

2. In LVDT, when core is moving to the right side, which of the following is correct

- A. $ES_1 < ES_2$
- B. $ES_1 = ES_2$
- C. $ES_1 > ES_2$
- D. $ES_1 = 2 * ES_2$

Answer: A.

3. LVDT is used to measure

- A. Temperature
- B. Pressure
- C. Displacement
- D. Level

Answer: C.

4. RVDT is used to sense

- A. Linear displacement
- B. Angular displacement
- C. Linear velocity
- D. Angular velocity

Answer: B

5. RVDT stands for

- A. Rotational Variable Differential transformer
- B. Rotary Variable Differential Transducer
- C. Rotary Variation Differential Transducer
- D. Rotary Variable Differential Transformer

Answer: B

6. The function of Hall sensor is based on the principle of

- A. Hall Effect
- B. Hall coefficient
- C. Hall Voltage
- D. Hall constant

Answer: A

7. Hall effect sensor is also used as

- A. position and proximity sensors
- B. temperature sensor
- C. Level sensor

D. Flow sensor

Answer: A

8. LVDT has how many secondary windings

- A. One
- B. Two
- C. Three
- D. Four

Answer: B

9. The working principle of an RVDT is based on

- A. Hall effect
- B. Variable reluctance
- C. Electromagnetic induction
- D. Piezoelectric effect

Answer: C.

10. The RVDT is a type of

- A. Active transducer
- B. Passive transducer
- C. Digital transducer
- D. Photonic transducer

Answer: B.

11. The primary winding in an RVDT is usually excited by

- A. DC voltage
- B. AC voltage
- C. Pulse voltage
- D. None of the above

Answer: B.

12. In RVDT, when the core is in the null position, the output voltage is

- A. Maximum positive
- B. Maximum negative
- C. Zero
- D. Constant

Answer: C.

13. The output of an RVDT is

- A. AC voltage proportional to angle
- B. DC voltage proportional to angle
- C. Current proportional to displacement
- D. Frequency proportional to displacement

Answer: A.

14. The Hall effect is used to measure

- A. Temperature
- B. Magnetic field strength
- C. Pressure
- D. Strain

Answer: B.

15. The Hall voltage is produced when a current-carrying conductor is placed

- A. In an electric field
- B. In a magnetic field perpendicular to the current
- C. In a thermal gradient
- D. Under mechanical stress

Answer: B.

16. The output of a Hall effect transducer is

- A. Current
- B. Voltage
- C. Frequency
- D. Resistance

Answer: B.

17. The Hall voltage is directly proportional to

- A. Current and magnetic field
- B. Current and resistance
- C. Magnetic field and temperature
- D. Voltage and resistance

Answer: A.

18. Hall effect sensors are mainly used for measuring

- A. velocity
- B. Acceleration
- C. Magnetic flux density
- D. Optical intensity

Answer: C.

19. LVDT is based on the principle of

- A. Self inductance
- B. Variable inductance
- C. Mutual inductance
- D. Magnetism

Answer: C.

20. In LVDT, when the core is at the centre, the output voltage is

- A. negative
- B. positive
- C. Zero
- D. not measurable

Answer: C.

21. Self inductance of the coil is directly proportional to

- A. Flux path through air
- B. Length of the air gap
- C. Reluctance of the air gap
- D. Number of turns

Answer: D.

22. Which transducer is used as error detector?

- A. RVDT
- B. LVDT
- C. Synchro
- D. Hall effect transducer

Answer: C.

23. LVDT stands for

- A. Linear Variable Differential transformer
- B. Linear Variable Differential Transducer
- C. Linear Variation Differential Transducer
- D. Linear Variation Differential Transformer

Answer: A.

24. In LVDT, when core is moving to the left side, which of the following is correct?

- A. $E_{S1} < E_{S2}$
- B. $E_{S1} = E_{S2}$
- C. $E_{S1} > E_{S2}$
- D. $E_{S1} = 2 * E_{S2}$

Answer: C.

25. The self inductance of a coil is directly proportional to

- A. Flux path through air
- B. Length of the air gap
- C. Reluctance of the air gap
- D. Number of turns

Answer: D.

Analytical type question

26. If the core of an LVDT moves away from the null position, what happens to the differential output voltage?

- A. Increases
- B. Becomes zero
- C. Remains unchanged
- D. Becomes infinite

Answer: A

27. If the magnetic field applied to a Hall-effect transducer increases, what happens to the Hall voltage?

- A. Increases
- B. Decreases
- C. Becomes zero
- D. Remains unchanged

Answer: A

28. If the current through a Hall-effect transducer is increased while the magnetic field remains constant, what happens to the Hall voltage?

- A) Increases
- B) Decreases
- C) Remains constant
- D) Becomes zero

Answer: A

29. When the rotor of an RVDT is at its null position, what is the ideal differential output voltage?

- A. Maximum
- B. Zero
- C. Infinite
- D. Negative maximum

Answer: B

30. An LVDT is used to monitor the movement of a hydraulic piston; which parameter is measured?

- A. Linear displacement
- B. Temperature
- C. Pressure
- D. Humidity

Answer: A

Descriptive Type Questions

1. With neat diagram, explain the working principle of LVDT.
2. Explain working principle of Hall effect transducer with its application.
3. Explain in detail about Variable reluctance type transducer.
4. a. With neat diagram, explain the working principle of RVDT
a. Give short notes on Synchros.

Analytical type question

1. (i) Assertion and Reason type question

(2)

Assertion (A): The differential output AC voltage of an LVDT undergoes a 180° phase shift when the core moves from one side of the null position to the other.

Reason (R): Moving the core changes the direction of the magnetic flux linkage, causing the induced voltage in one secondary coil to become greater than the induced voltage in the other secondary coil.

Options:

- (a) Both (A) and (R) are true, and (R) is the correct explanation of (A).
- (b) Both (A) and (R) are true, but (R) is *not* the correct explanation of (A).
- (c) (A) is true, but (R) is false.
- (d) Both (A) and (R) are false.

Answer:(a)Both (A) and (R) are true, and (R) is the correct explanation of (A).

(ii) Identify the device.

(2)

It is a variation of linear variable differential transformer used to sense the angular displacement.

Answer: RVDT(Rotary Variable Differential Transformer)

(iii) Select the two correct statements

(2)

- a) RVDT is used as an error detector
- b) LVDT works on the principle of Mutual Inductance
- c) Hall effect transducer works on the principle of seebeck effect
- d) Hall effect sensors can also be used as position and proximity sensors
- e) Self inductance of the coil is inversely proportional to number of turns.

Answer: b) and d)

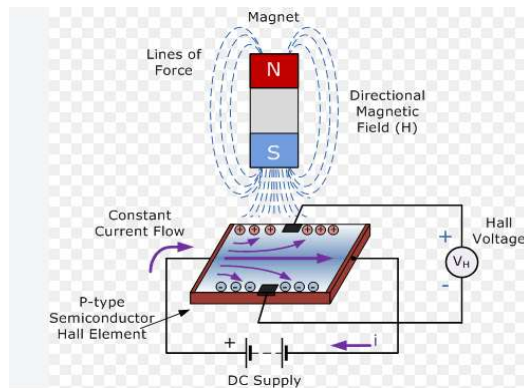
(iv) Arrange the steps in correct order related to the working of LVDT in measurement of displacement. (2)

- a) The shifting core alters the magnetic path, causing a higher magnetic flux to link with one secondary coil over the other.
- b) An alternating current (AC) excitation voltage is applied to the central primary coil to generate a continuous magnetic field.
- c) The primary coil induces unequal AC voltages(V_1 and V_2) across the two balanced secondary coils.
- d) An external mechanical displacement pushes the high-permeability iron core away from its central null position.
- e) A differential output voltage $V_{out} = V_1 - V_2$ is measured, providing a clear magnitude and direction of the movement.

Answer: b) → d)→a) → c)→ e)

v) Read the working principle and draw the diagram of corresponding transducer (2)

A transducer used for measuring the magnetic flux by converting it into an emf. It can also be used as position and proximity sensors.



UNIT IV

MultiChoice Questions.

1. Capacitance-type level measurement works on which basic principle?

- A. Electromagnetic induction
- B. Change in capacitance due to level variation
- C. Change in resistance with temperature
- D. Ultrasonic wave reflection

Answer: B

2. In a capacitance level sensor, the tank wall and probe act as

- A. Two resistors
- B. Two inductors
- C. Two plates of a capacitor
- D. Two diodes

Answer: C

3. The capacitance in a level sensor changes primarily because

- A. The voltage applied changes
- B. The distance between plates changes
- C. The dielectric constant between plates changes
- D. The probe length changes physically

Answer: C

4. Which of the following is *not* a suitable material for a capacitance probe

- A. Stainless steel
- B. PTFE-coated metal
- C. Glass
- D. Rubber band

Answer: D

5. Capacitance-type level measurement is most suitable for

- A. Conductive and non-conductive liquids
- B. Only gases
- C. Only magnetic materials
- D. Only solids

Answer: A

6. The dielectric constant of the process material affects the

- A. Frequency of oscillation
- B. Capacitance value
- C. Temperature of the probe
- D. Pressure inside the tank

Answer: B

7. In a typical capacitance level measurement system, the reference electrode is usually

- A. The tank wall (if metal)
- B. The air surrounding the tank
- C. The insulation material
- D. The power supply ground

Answer: A

8. If the dielectric constant of a liquid increases, the measured capacitance will

- A. Decrease
- B. Increase
- C. Stay the same
- D. Oscillate randomly

Answer: B

9. A piezoelectric transducer works on which basic principle

- A. Change in resistance with temperature
- B. Generation of voltage when mechanical stress is applied
- C. Change in inductance with displacement
- D. Change in capacitance due to pressure

Answer: B

10. Which of the following materials is commonly used in piezoelectric transducers

- A. Quartz
- B. Copper
- C. Silicon
- D. Iron

Answer: A

11. The effect by which mechanical stress produces an electrical voltage in a crystal is called

- A. Hall effect
- B. Seebeck effect
- C. Piezoelectric effect
- D. Photoelectric effect

Answer: C

12. The piezoelectric effect is reversible, it means it

- A. convert electrical energy into heat
- B. converts mechanical energy into electrical energy and vice versa
- C. Only generate electricity from motion
- D. Only produce vibration

Answer: B

13. Piezoelectric transducers are most commonly used to measure

- A. Temperature
- B. Pressure and vibration
- C. Electric current
- D. Light intensity

Answer: B

14. The output of a piezoelectric transducer is usually

- A. DC voltage
- B. AC voltage proportional to applied stress
- C. Constant current
- D. Magnetic field

Answer: B

15. The main property of piezoelectric crystal is

- A. Stability
- B. linearity
- C. thickness
- D. Sensitivity

Answer: A

16. In piezoelectric transducer, quartz refers to

- A. Natural piezoelectric material
- B. Manmade piezoelectric material
- C. Polycrystalline
- D. Polymer

Answer : A.

17. In piezoelectric transducer, elements exhibiting piezoelectric qualities are called

- A. Electrocapacitive elements
- B. Electroresistive elements
- C. Nonsensitive elements
- D. sensitive elements

Answer: B.

18. In capacitance type level measurement, the dielectric is

- A. Teflon
- B. Plastic
- C. Aluminium
- D. Copper

Answer : A.

19. The Natural Piezo electric material is

- A. Quartz
- B. Ammonium dihydrogen phosphate
- C. Lithium sulphate
- D. Potassium dihydrogen phosphate

Answer : A.

20. The Manmade Piezo electric material is

- A. Quartz
- B. Rochelle salts
- C. Ammonium dihydrogen phosphate
- D. Plastic.

Answer : A.

21.The capacitance is directly proportional to

- A. Overlapping area of plates
- B. Distance between two plates
- C. Permittivity of medium
- D. Cross sectional area of plates

Answer : A.

22.The capacitance is inversely proportional to

- A. Overlapping area of plates
- B. Distance between two plates
- C. Permittivity of medium
- D. Cross sectional area of plates

Answer : B.

23.Capacitance is the ability to store

- A. Electric charge
- B. Temperature
- C. Pressure
- D. force

Answer : A.

24. The commonly used dielectric material is

- A. Iron
- B. Stainless steel
- C. Mica
- D. Polythene

Answer : C.

25. Capacitance transducers are used to measure

- A. Angular velocity
- B. Angular displacement
- C. Linear velocity
- D. Linear displacement

Answer : D.

Analytical type question

26. If mechanical stress is applied to a piezoelectric crystal, what is produced across its surfaces?

- A. Electrical voltage
- B. Magnetic field
- C. Heat
- D. Light

Answer: A

27. Why is the piezoelectric effect used in vibration sensors?

- A. Mechanical vibration produces a corresponding electrical signal
- B) It increases the vibration
- C) It converts heat into pressure
- D) It measures humidity

Answer: A

28. A piezoelectric crystal is compressed along its polar axis; what effect is primarily observed?

- A. Production of electric charge
- B. Increase in temperature
- C. Decrease in density
- D. Emission of light

Answer: A

29. When a piezoelectric crystal is subjected to mechanical stress, the magnitude of charge produced mainly depends on

- A. The applied mechanical stress
- B. The colour of the crystal
- C. Atmospheric pressure alone
- D. Its external shape only

Answer: A

30. Why does a capacitive level sensor detect changes in liquid level?

- A. The dielectric constant between the electrodes changes
- B. The temperature always decreases
- C. The electrode resistance becomes zero
- D. The liquid becomes magnetic

Answer: A

DescriptiveTypeQuestions

1. Explain in detail about Piezoelectric transducer
2. With neat diagram, explain capacitance type level measurement of non-conductive and conductive fluids.
3. a) With neat diagram, explain capacitance transducer using change in area of plates.
b) Give short notes on capacitance transducer using change in distance between plates

Analytical type question

1. (i) Assertion and Reason type question

(2)

Assertion (A): Natural quartz crystals exhibit the direct piezoelectric effect and generate an electrical voltage when mechanically squeezed.

Reason (R): All crystalline materials found in nature possess the necessary asymmetrical molecular structure required to exhibit piezoelectric properties.

Options:

- (a) Both (A) and (R) are true, and (R) is the correct explanation of (A).
- (b) Both (A) and (R) are true, but (R) is *not* the correct explanation of (A).
- (c) (A) is true, but (R) is false.
- (d) Both (A) and (R) are false.

Answer:(c) (A) is true, but (R) is false.

(ii) Identify the device.

(2)

An electric potential appears across certain surfaces of the crystal, if the dimensions of the crystal are changed by the application of mechanical force. .It uses electro-resistive elements.

Answer: Piezo electric transducer

(iii) Select the two correct statements

(2)

- a) Quartz is a man made piezo electric material.
- b) Oil is a dielectric medium
- c) Capacitance is the ability to store electric charge
- d) Capacitance is directly proportional to distance between two plates
- e) Natural crystals cannot withstand higher stress

Answer: b) and c)

(iv) Arrange the steps in correct order related to the working of capacitance type level measurement.

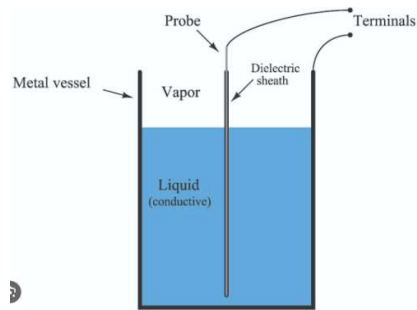
(2)

- a)The total electrical capacitance between the probe and the tank wall increases because the liquid has a higher dielectric constant than air.
- b)An electronic transmitter applies a high-frequency AC voltage to the probe setup.
- c) The liquid level rises inside the tank, filling the empty space between the probe and the tank wall.
- d) An insulated metal probe is inserted vertically into the storage tank to act as one plate of a capacitor, while the metal tank wall acts as the second plate.
- e) The changing liquid level displaces the air, which alters the average dielectric constant of the material between the plates.
- f) The circuit measures the changing electrical current or frequency and converts it into a standard output signal (like 4–20 mA) representing the exact liquid level.

Answer: d) → b)→ c)→e)→ a) → f)

v) Read the working principle and draw the diagram of corresponding transducer (2)

When level changes, the dielectric constant gets changed. Hence the capacitance varies. By using signal conditioning circuits, this change in capacitance can be converted into desired control signals



UNIT V

MultiChoice Questions.

1. The Wheatstone bridge is used to measure

- A. Voltage
- B. Current
- C. Resistance
- D. Capacitance

Answer: C.

2. The Wheatstone bridge is said to be balanced when

- A. The galvanometer shows maximum deflection
- B. The galvanometer shows zero deflection
- C. The battery voltage is maximum
- D. None of the above

Answer: B.

3. In an unbalanced Wheatstone bridge, the ratio of resistances in one branch is equal to

- A. The sum of resistances in the other branch
- B. The ratio of resistances in the other branch
- C. The product of resistances in the other branch
- D. None of these

Answer: B.

5. The galvanometer in the Wheatstone bridge is used to

- A. Supply current
- B. Measure voltage directly
- C. Detect current flow between two points
- D. Balance resistances automatically

Answer: C.

6. If the galvanometer shows deflection in a Wheatstone bridge, it refers that

- A. The bridge is balanced
- B. The bridge is unbalanced
- C. The battery is disconnected
- D. The resistances are equal

Answer: B.

7. In a balanced Wheatstone bridge, current through the galvanometer is

- A. Maximum
- B. Minimum
- C. Zero
- D. Infinite

Answer: C.

8. The main advantage of using a Wheatstone bridge is

- A. It can measure very high voltages
- B. It gives very accurate measurement of resistance
- C. It can amplify weak signals
- D. It works without a power supply

Answer: B.

9. The Wheatstone bridge was invented by

- A. Charles Wheatstone
- B. Thomas Edison
- C. James Clerk Maxwell
- D. Ohm

Answer: A.

10. The ideal Op-Amp has input impedance that is

- A. Very low
- B. Very high
- C. Zero
- D. Moderate

Answer: B.

11. The ideal Op-Amp has output impedance that is

- A. Very high
- B. Infinite
- C. Zero
- D. Equal to input impedance

Answer: C.

12. The ideal Op-Amp has open-loop gain equal to

- A. 1
- B. 10
- C. 10^5
- D. Infinite

Answer: D.

13. In an ideal Op-Amp, the input offset voltage is

- A. Infinite
- B. Zero
- C. Very high
- D. Depends on frequency

Answer: B.

14. The Common-Mode Rejection Ratio (CMRR) of an ideal Op-Amp is

- A. 0
- B. 1
- C. Infinite
- D. 100

Answer: C.

15. The input terminals of an Op-Amp are

- A. One input and one output
- B. Two inputs and one output
- C. Three inputs and two outputs
- D. Three inputs and three outputs

Answer: B.

16. A Charge amplifier is an

- A. Electronic current integrator
- B. Electronic voltage integrator
- C. Electrical current integrator
- D. Electrical voltage integrator

Answer: A.

17. Activelowpassfilter allows

- A. Onlylowfrequencycomponents
- B. Onlyhighfrequencycomponents
- C. Onlyone bandof frequencies
- D. Onlyveryhighfrequency components

Answer:A.

18. Activehigh passfilter allows

- A. Onlylowfrequencycomponents
- B. Onlyhighfrequencycomponents
- C. Onlyone bandof frequencies
- D. Onlyveryhighfrequencycomponents

Answer:B.

19. ActiveBandpassfilterallows

- A. onlylowfrequencycomponents
- B. onlyhighfrequencycomponents
- C. onlyone bandoffrequencies
- D. onlyveryhighfrequencycomponents

Answer:C.

20. ActiveBandstop filterrejects

- A. onlylowfrequencycomponents
- B. onlyhighfrequencycomponents
- C. a particular band of frequencies
- D. onlyveryhighfrequencycomponents

Answer: C.

21. Pin no. 2 of IC741 is

- A. **Non- Inverting input**
- B. **Inverting input**
- C. **Output**
- D. **Ground**

Answer:B.

22. Pin no. 3 of IC741 is

- A. Ground
- B. Inverting input
- C. Output
- D. Non- Inverting input

Answer:D.

23. Pin no. 6 of IC741 is

- A. Ground
- B. Inverting input
- C. Output
- D. Non- Inverting input

Answer:C.

24. Which component pass the signals of wanted frequencies and reject unwanted frequencies?

- A. Filter
- B. Amplifier
- C. bridge
- D. Transducer

Answer:A.

25. The gain of an amplifier is based on

- A. Input capacitor
- B. Feedback resistor
- C. Output resistor
- D. Output capacitor

Answer:B.

Analytical type question

26. If the resistance of one arm of a balanced Wheatstone bridge increases, what happens to the bridge condition?

- A. It becomes unbalanced
- B. It remains balanced
- C. Current becomes zero everywhere
- D. Voltage supply becomes zero

Answer: A

27. If the detector in a Wheatstone bridge shows zero current, what can be concluded?

- A. The bridge is balanced
- B. All resistances are zero
- C. The supply is disconnected
- D. The bridge is short-circuited

Answer: A

28. When a strain gauge is connected in a Wheatstone bridge and its resistance changes due to strain, what is primarily affected?

- A. Bridge output voltage
- B. Supply frequency
- C. Wire length only
- D. Ambient pressure

Answer: A

29. If a filter allows low-frequency signals to pass while attenuating high-frequency signals, which type of filter is it?

- A. Low-pass filter
- B. High-pass filter
- C. Band-pass filter
- D. Band-stop filter

Answer: A

30. If a filter strongly attenuates signals around one particular unwanted frequency while passing other frequencies, which filter is being used?

- A. Band-stop filter
- B. Low-pass filter
- C. High-pass filter
- D. Band-pass filter

Answer: A

Descriptive Type Questions

1. Explain in details about Wheatstone bridge.
2. Explain DC signal conditioning system with block diagram.
3. Explain AC signal conditioning system with block diagram.
4. Explain in detail about any two type of Active filters.

Analytical type question

1. (i) Assertion and Reason type question

(2)

Assertion (A): In a balanced Wheatstone bridge, no electric current flows through the central galvanometer even when the main circuit switch is closed.

Reason (R): When the bridge is balanced, the electrical potential at both terminals of the galvanometer becomes exactly equal, resulting in a potential difference of zero.

Options:

- (a) Both (A) and (R) are true, and (R) is the correct explanation of (A).
- (b) Both (A) and (R) are true, but (R) is *not* the correct explanation of (A).
- (c) (A) is true, but (R) is false.
- (d) Both (A) and (R) are false.

Answer: (a) Both (A) and (R) are true, and (R) is the correct explanation of (A)..

(ii) Identify the device.

(2)

A device which allows(passes) only low frequency components and rejects(blocks) all other high frequency components.

Answer: Active Low pass filter

(iii) Select the two correct statements

(2)

- a) Wheatstone bridge consists of three arms.
- b) An ideal op-amp should have finite input impedance
- c) Pin no. 2 of IC741 op-amp is Inverting input.
- d) An ideal op-amp has infinite output impedance.
- e) An ideal op-amp has infinite open loop gain.

Answer: c) and e)

(iv) Arrange the steps in correct order related to the working of wheatstone bridge in measurement of unknown resistance.

(2)

- a) The galvanometer shows zero deflection at the balance point.
- b) The unknown resistance is connected in one arm of the Wheatstone bridge.
- c) The known resistances are adjusted until the bridge is balanced.
- d) The value of the unknown resistance is calculated using the Wheatstone bridge balance equation.

Answer:b)→c) → a) → d)

v) Read the working principle and draw the output response of corresponding filter

(2)

A filter which allows(passes) only low frequency components and rejects (blocks) all other high frequency components.

