



**MAHARASHTRA STATE BOARD OF TECHNICAL EDUCATION**  
**(Autonomous)**  
**(ISO/IEC – 27001 – 2005 Certified)**

---

**SUMMER – 14 EXAMINATION**

**Model Answer**

Subject Code : 17434

Page No: 1/

**Important Instructions to examiners:**

- 1) The answers should be examined by key words and not as word-to-word as given in the model answer scheme.
- 2) The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate.
- 3) The language errors such as grammatical, spelling errors should not be given more Importance (Not applicable for subject English and Communication Skills).
- 4) While assessing figures, examiner may give credit for principal components indicated in the figure. The figures drawn by candidate and model answer may vary. The examiner may give credit for any equivalent figure drawn.
- 5) Credits may be given step wise for numerical problems. In some cases, the assumed constant values may vary and there may be some difference in the candidate's answers and model answer.
- 6) In case of some questions credit may be given by judgement on part of examiner of relevant answer based on candidate's understanding.
- 7) For programming language papers, credit may be given to any other program based on equivalent concept.

**Q1. a) Attempt any SIX of the following.**

**(12M)**

**i) Classify transducer in detail.**

**Ans : (2M)**

1. Active and Passive transducers.
2. Analog and digital transducers.
3. Primary and secondary transducers.
4. Electrical and mechanical transducers.
5. Transducers and inverse transducers.

**ii) State selection criteria of transducer.**

**Ans : (Any four, 2M)**

1. Operating range
2. Operating principle.
3. Sensitivity
4. Accuracy
5. Frequency response and resonant frequency
6. Errors
7. Environmental compatibility
8. Usage and ruggedness
9. Electrical aspect
10. Stability and Reliability
11. Loading effect
12. Static characteristics
13. General selection criteria.

**iii) Define absolute pressure, atmospheric pressure.**

**Ans : (Each one, 1M)**

**Absolute Pressure :** Absolute pressure is defined as actual total pressure including atmospheric pressure acting on a surface

$$P_{\text{Absolute}} = P_{\text{Atmospheric}} + P_{\text{Gauge}}$$

Unit of absolute pressure is pounds per square inch absolute and it is represented by psia.

**Atmospheric Pressure :** Atmospheric Pressure or Barometric pressure is defined as the pressure exerted by the air surrounding to the earth. Unit of atmospheric pressure is Pounds per square inch.

**iv) List variable flow meter.**

**Ans : (2M)**

1. Variable area : Rotameter
2. Variable head :
  - a) Venturi
  - b) Orifice
  - c) Pitot tube
  - d) Nozzle

**v) State laminar and turbulent flow.**

**Ans : (Each one, 1M)**

**Laminar flow :** When a fluid flowing through the pipe at different speeds (fast at center and slow at edges), and the fluid particles move in layers with one layer sliding over the adjacent layer, the flow is said to be laminar flow.

Reynolds no is less than 2000

**Turbulent flow :** When the particles of fluid move in disorderly manner, occupying different relative positions in successive cross sections, then this flow is called as turbulent flow.

Reynolds no is greater than 4000

**vi) State temperature and list units of temperature.**

**Ans : (definition 1M, Units 1M)**

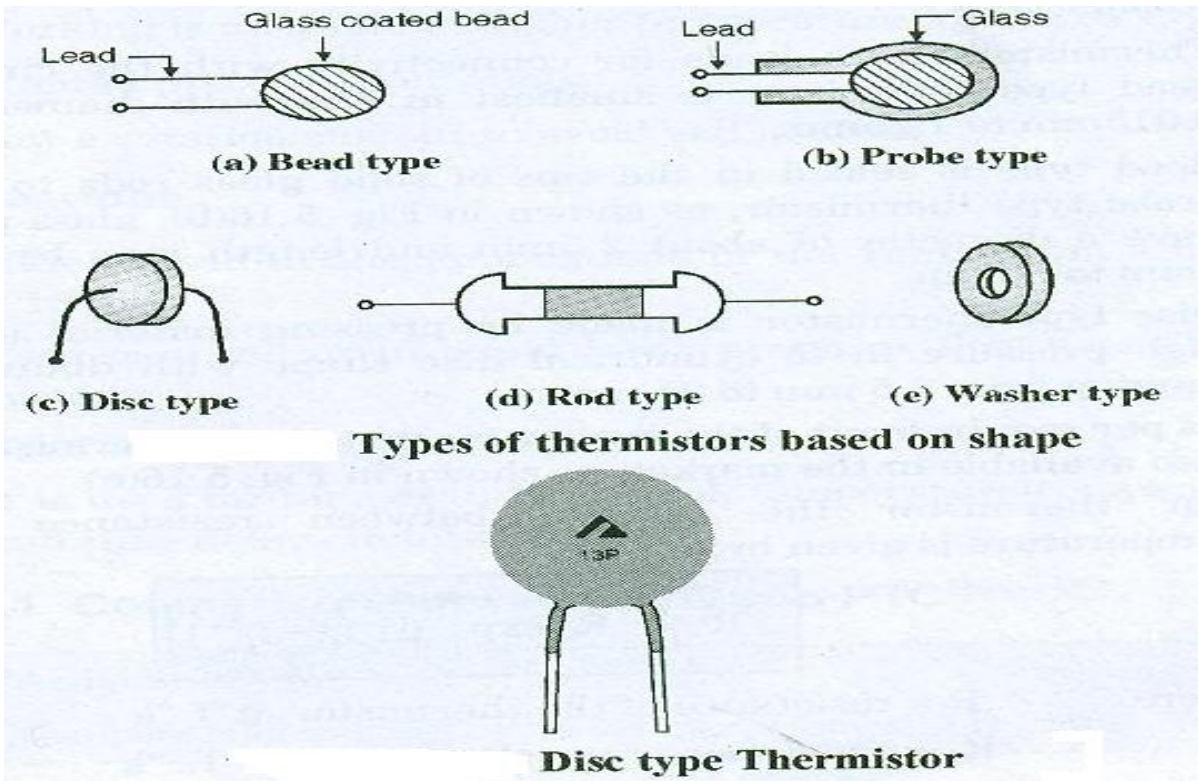
**Temperature** is defined as, it is a degree of hotness or coldness of a body or an environment measured on a definite scale.

Temperature units :

- Fahrenheit ( $^{\circ}\text{F}$ )
- Celsius ( $^{\circ}\text{C}$ )
- Kelvin ( $^{\circ}\text{K}$ )
- Rankine ( $^{\circ}\text{R}$ )
- Reaumur ( $^{\circ}\text{R}'$ )

**vii) Draw the different shapes of thermistors.**

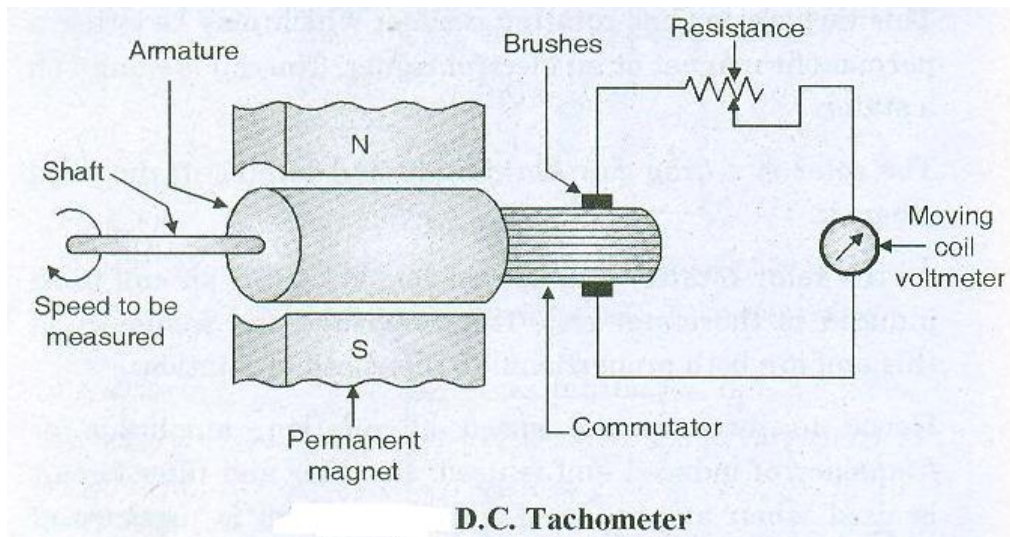
**Ans : (Any 2, 2M)**



viii) Draw DC tachometer neatly.

Ans :

(2M)



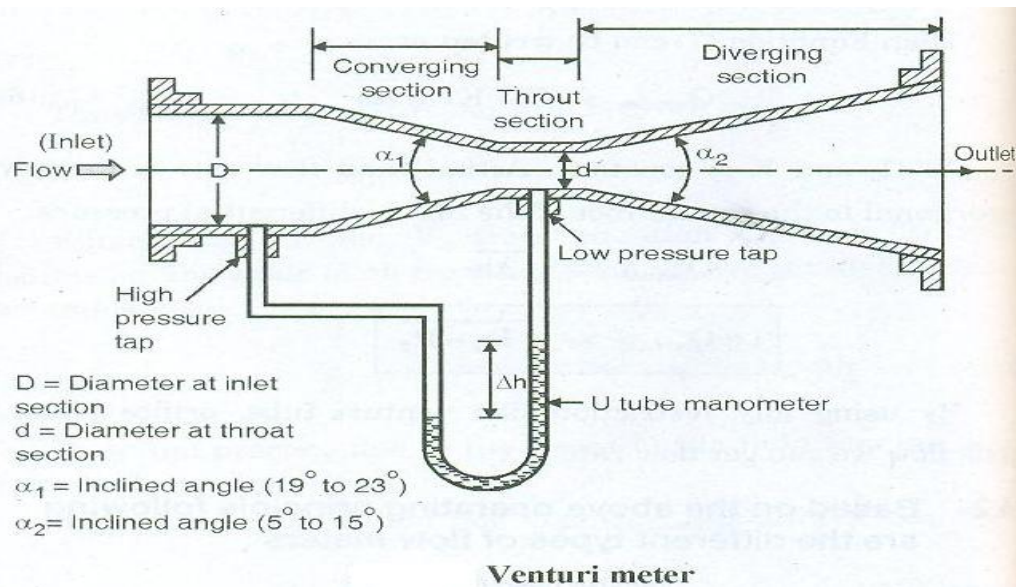
b) Attempt any TWO of the following :

(8M)

a) Draw venture meter and write steps to measure flow rate.

Ans :

(Diagram 2M, explanation 2M)



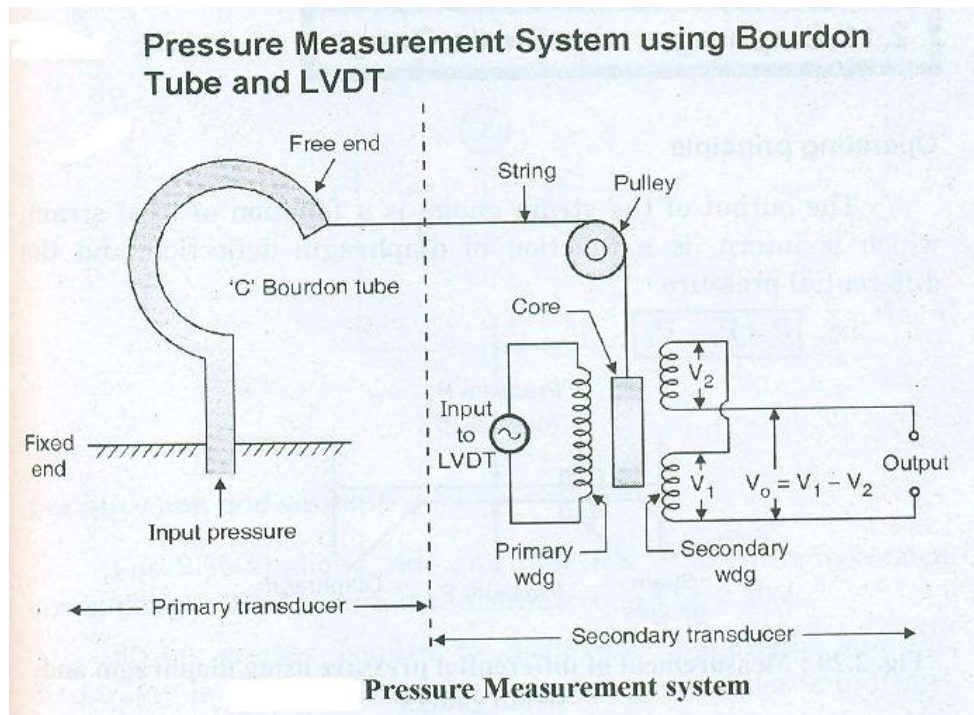
- Venturi meter consists of three sections that is converging section, throat section and diverging section.
- The flow is introduced to the meter through the inlet with diameter 'D' . The inclined angle of the converging section is  $\alpha_1$  which may be between  $19^\circ$  to  $23^\circ$ .
- The flow is then passed through the throat section which have the diameter 'd'.
- Two pressure taps (one at inlet section and second is at middle of throat section) are provided to measure the pressure difference by using U-tube manometer as shown in figure.
- The diversion section has inclined angle  $\alpha_2$  which may be between  $5^\circ$  to  $15^\circ$ .
- Flow rate is proportional to the square root of the differential pressure.

Flow rate  $\propto \sqrt{P_1 - P_2}$

b) Draw Bourdon tube with LVDT setup for pressure measurement.

Ans :

(4M)



c) List the different level measurement methods.

Ans :

(4M)

Liquid Level Measurement

- Direct method
  1. Hook type
  2. Sight glass gype
  3. Float type
  4. Dip stick
- Indirect method
  1. Hydraustatic pressure type
  2. Electrical type
    - a) Capacitance level indicator
    - b) Radiation level detector
    - c) Ultrasonic level gauge
  3. Radar type

**Q2. Attempt any FOUR of the following :**

**(16M)**

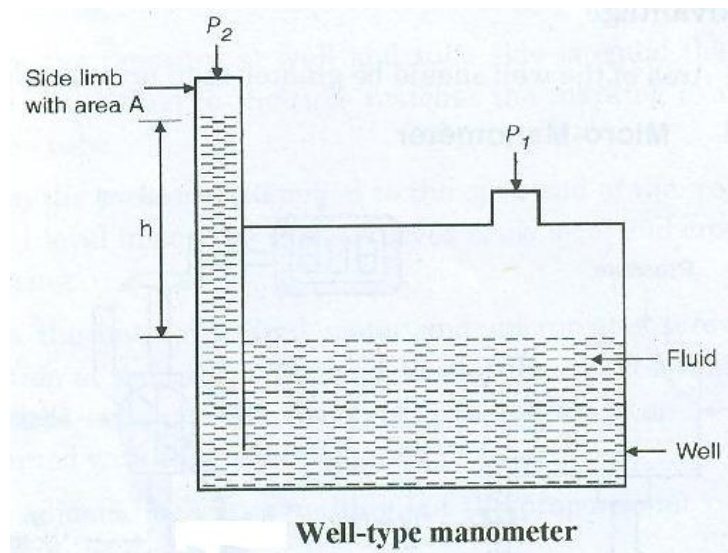
**a) Draw the following and write application of each.**

- i. Well type manometer**
- ii. Bellows.**

**Ans :**

**1. Well type manometer**

**(2M)**

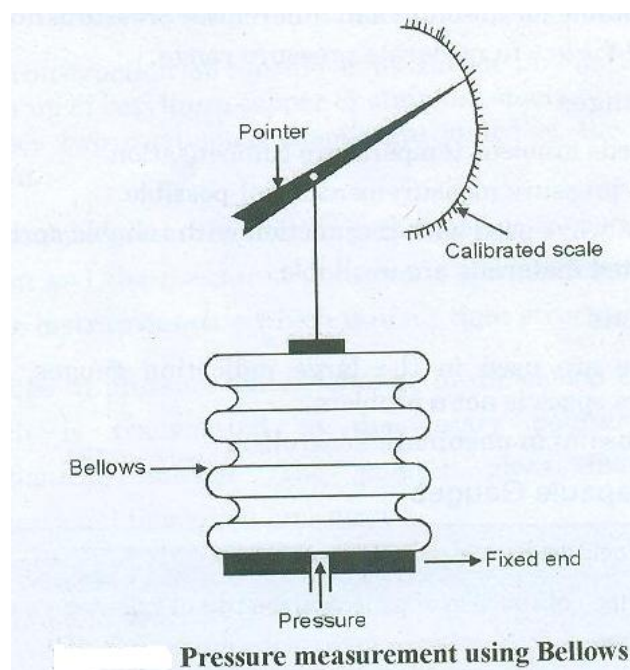


**Application :**

- Manometers are used in flow, pressure and force measurement systems.

**2. Bellows**

**(2M)**



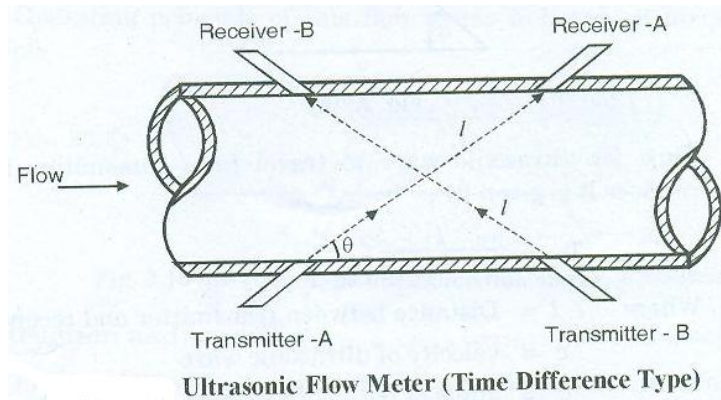
Applications :

- i. These are used in the large indicating gauges, recorders where space is not a problem.
- ii. It is useful in pneumatic controllers.

**b) Draw ultrasonic flow meter and explain its construction.**

**Ans :**

**(Diagram 2M, explanation 2M)**



**Construction :**

- Figure shows the construction of time difference type ultrasonic flow meter. This consists of two transmitters and two receivers. These are separated by distance  $l$  and mounted as shown in figure.
- Transmitter A transmits the waves pulsed of short duration in the direction of receiver A, this favor the wave as it is in direction of flow.
- Transmitter B transmits the waves pulsed of short duration in the direction of receiver B, this do not favor the wave as it is opposite to the direction of flow.

**c) List advantages and disadvantages of Radiation type level measurement method.**

**Ans :**

**Advantages :**

**(2M)**

1. Quite suitable for large reservoirs of 30-40 m diameter.
2. Continuous measurement is possible.
3. Non-contact device.
4. Measurement is independent on temperature, pressure, corrosion, etc.
5. Rigid construction and withstand severe operating conditions.

**Disadvantages :**

**(2M)**

1. It is risky to use this method due to radiation effects.
2. Adequate shielding is required to limit the radiation field intensity.



d) Convert 30° C temperature into kelvin, faranite units.

Ans :

Given =

Temp = 30° C

1) Temperature = °K = ?

$$\begin{aligned} ^\circ\text{K} &= ^\circ\text{C} + 273.15 \\ &= 30 + 273.15 \\ &= 303.15 ^\circ\text{K} \end{aligned}$$

Therefore, Temperature = 303.15 °K

(2M)

2) Temp = 30° C

Temperature = °F = ?

$$\begin{aligned} ^\circ\text{F} &= ^\circ\text{C} * 1.8 + 32 \\ &= 30 * 1.8 + 32 \\ &= 86 ^\circ\text{F} \end{aligned}$$

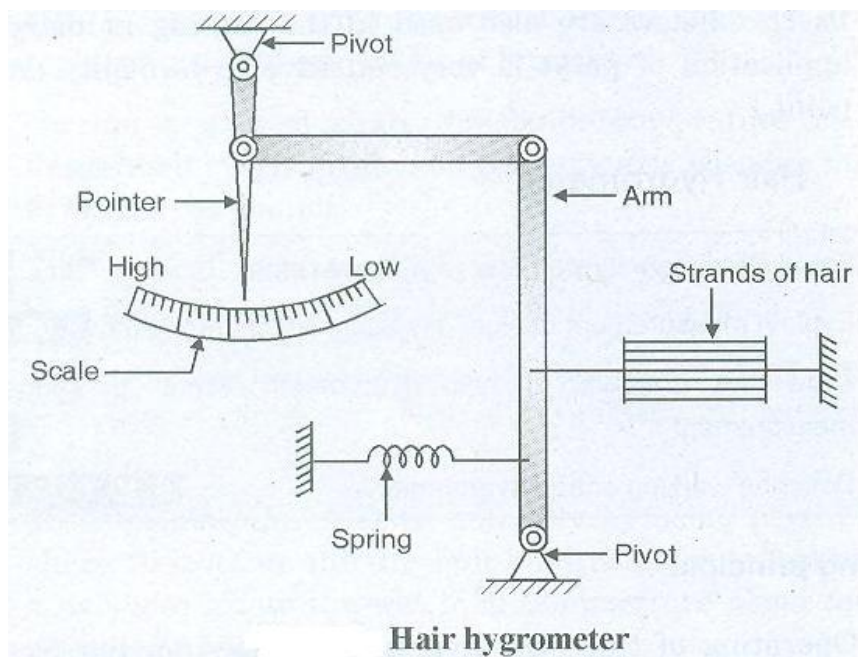
Therefore, Temperature = 63.8 °F

(2M)

e) State humidity and draw hair type hygrometer.

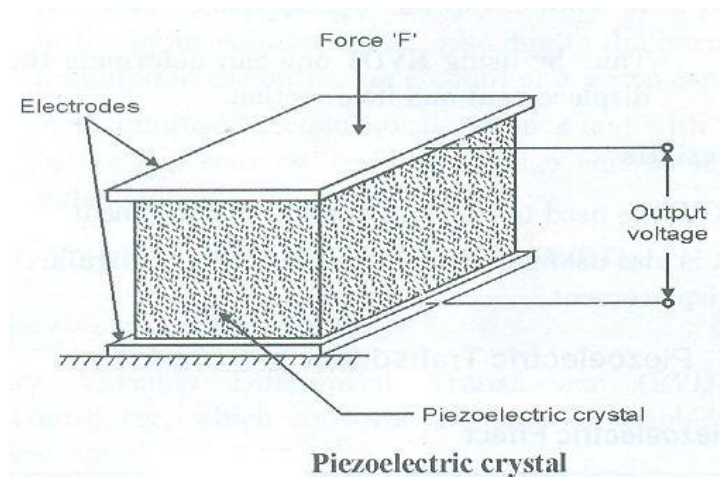
Ans : (Diagram 3M, Definition 1M)

Humidity is defined as it is a measure of water vapors present in the surrounding air.



f) State working principle of piezoelectric transducer with diagram.

Ans : (Diagram 2M, Explanation 2M)



**Working principle:**

When force or pressure is applied to the piezoelectric material like quartz crystal or barium titanate, then an e.m.f. is generated across the material or vice versa.

- The piezoelectric element used for converting mechanical movement into electrical signals.
- The mechanical deformation generates a charges and this charges appears as a voltage across the electrodes.

The voltage is given by ,

$$V = Q / C$$

Where V = e.m.f across electrode

Q = Charges

C = capacitance

**Q3. Attempt any FOUR of the following : (16M)**

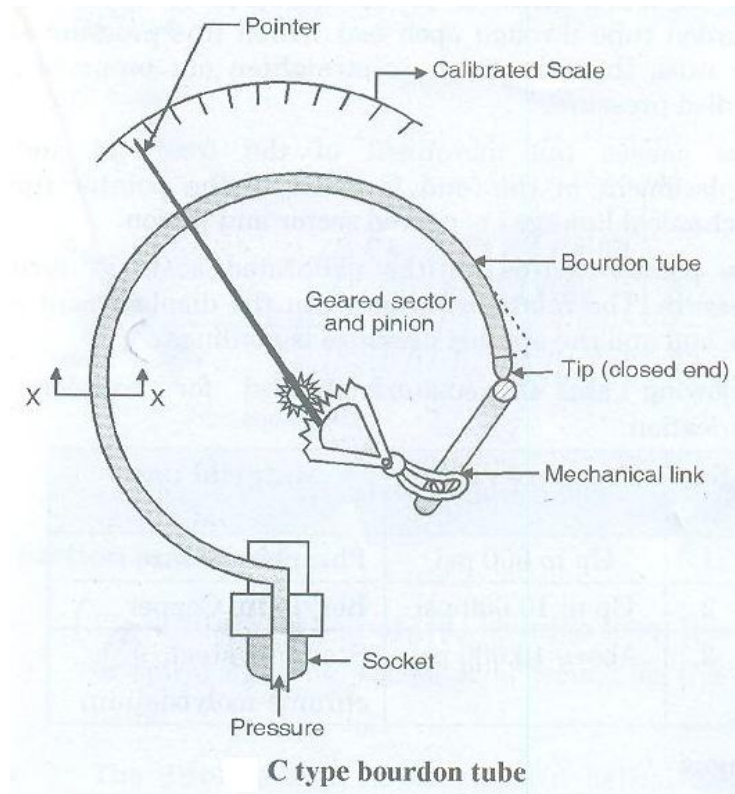
a) Compare active transducer with passive transducer based on working principle, example, advantage, application.

Ans:- (Four Points – 1 Mark Each)

Sr. No.	Parameters	Active Transducer	Passive Transducer
1	Working Principle	Operate under energy conversion principle.	Operate under energy controlling principle.
2	Example	Thermocouple, Piezoelectric Transducer etc.	Thermistors, Strain Gauges etc.
3	Advantage	Do not require external power supply for its operation.	Require external power supply for its operation.
4	Application	Used for measurement of Surface roughness in accelerometers and vibration pick ups.	Used for measurement of Power at high frequency.

b) Draw and describe construction and working of Bourdon tube.

Ans: (Any one type of Bourdon Tube) (Diagram – 2 Marks, Explanation – 2 Marks)

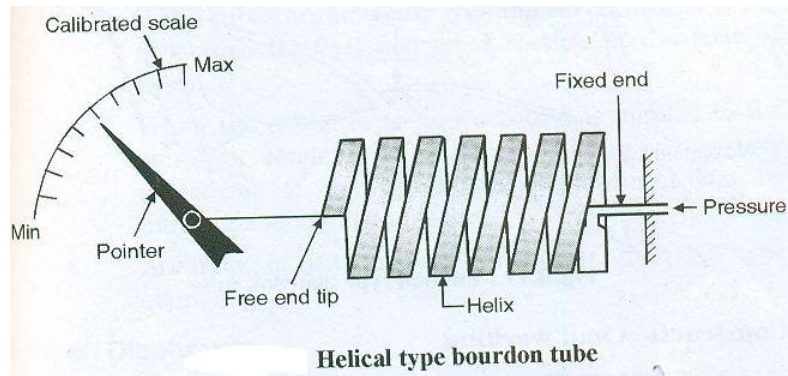


**Construction and working :**

- C type bourdon tube is made up of an elliptically flattened tube bent in such a way as to produce the 'C' shape as shown in the figure. One end (free end) of this tube is closed or sealed and the other end (fixed end) opened for the pressure to enter.
- The free end connected to the pointer with the help of geared sector and pinion. Calibrated scale and pointer is provided to indicate the pressure.
- The cross section view of 'C' type bourdon tube under normal condition and pressurized condition is as shown in figure.
- The pressure which is to be measured is applied to the bourdon tube through open end. When this pressure enters the tube, the tube tends to straighten out proportional to applied pressure.
- This causes the movement of the free end and the displacement of this end is given to the pointer through mechanical linkage i.e. geared sector and pinion.
- The pointer moves on the calibrated scale in terms of pressure. The relationship between the displacement of the free end and the applied pressure is nonlinear.

**OR**

## Helical Tube

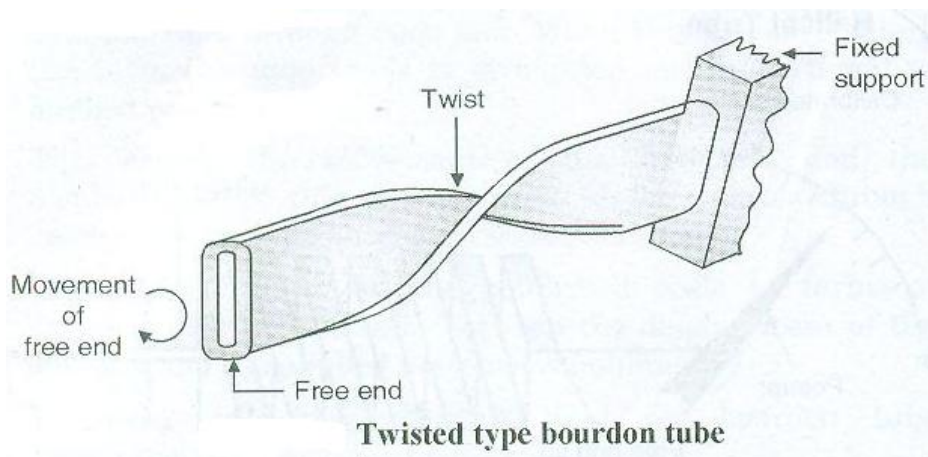


### Construction and working :

- Figure shows helical type bourdon tube. It is similar to spiral element, except it is wound in the form of helix.
- The displacement of the tip of a helical element is larger than the spiral element.
- Central shaft is installed (not shown in fig.) within a helical element and the pointer is driven by this shaft using connecting links.
- This mechanism transmits only the circular motion of the tip to the pointer which is directly proportional to the applied pressure.

OR

## Twisted Tube

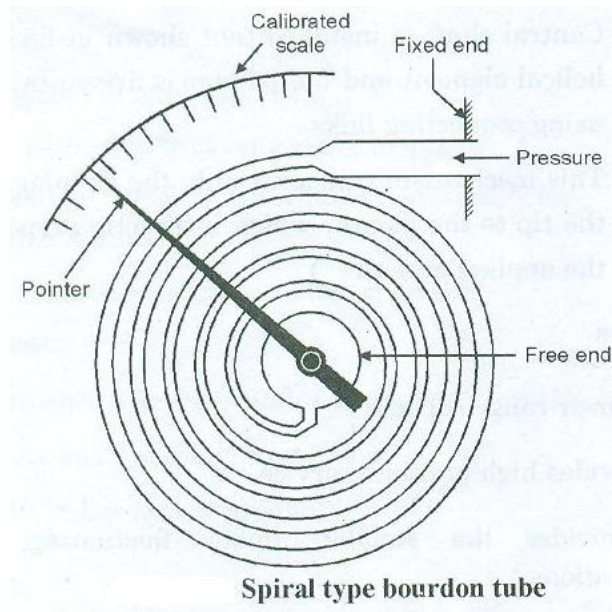


### Construction and working :

- Twisted bourdon tube element is as shown in figure. One end of the tube is fixed and other end is free for application of the twist.
- As we apply the pressure at the free end, it gives rotation or creates the twist at that end. As we remove the pressure the free end try to retain its original position.

OR

## Spiral Tube



### Construction and working :

- Spiral type bourdon tube is as shown in figure. Spiral tubes are made by winding several turns of the tube with its flattened cross section in the form of spiral.
- When the pressure to be measured is applied to the spiral, it tends to uncoil producing relatively long movement of the tip whose displacement can be indication of applied pressure.
- Accuracy of this element is higher than 'C' type element.

### c) State the use of RADAR and list two advantages.

**Ans: (any two points) (use of RADAR – 2 Marks, Advantages – 2 Marks)**

#### Use of radar:

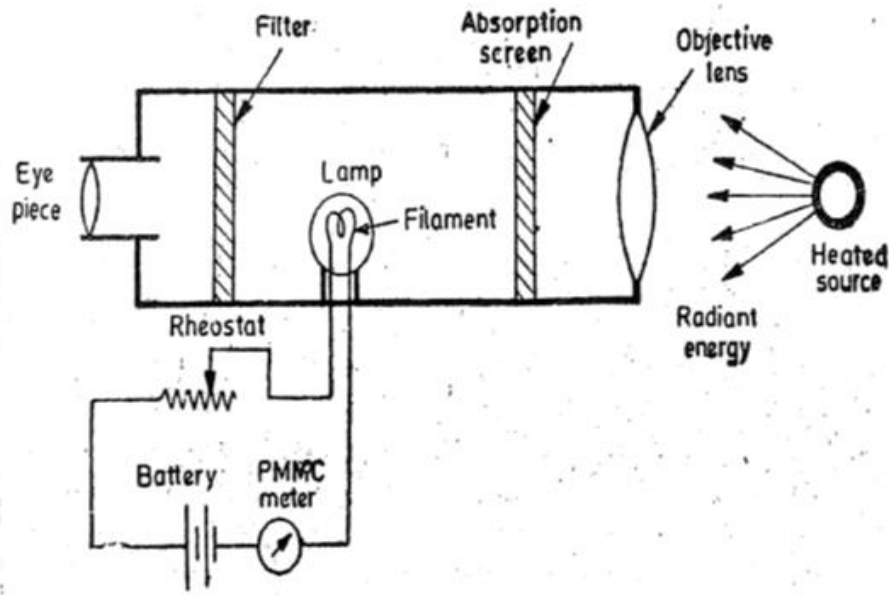
1. Suitable for large tanks with a range upto 200m
2. Top mounted radar level gauges are used for continuous level measurement.

#### Advantages :

1. This is non-contact technology,
2. High accuracy for measurements in storage tanks and some process vessels.

d) Draw neat labeled diagram of optical pyrometer.

Ans:- (Diagram – 4 Marks)



e) List two advantages and disadvantages of photoelectric pickup transducer.

Ans: (any 2 relevant points) (Advantages – 2 Marks, Disadvantages – 2 Marks)

**Advantages :**

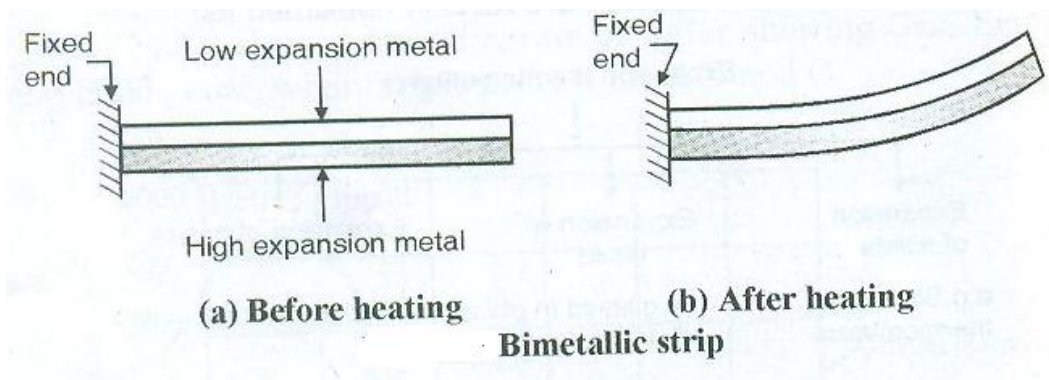
1. No direct physical contact of the meter with rotating shaft whose speed to be measured. Hence no additional load on the shaft.
2. Output is in digital format.
3. No A/D converted is required.
4. Electronic circuitry is simple because the pulse amplitudes are constant.
5. Continuous measurement is possible.

**Disadvantages:**

1. Life span of light source is limited (typically 50,000 hours.)
2. The accuracy of meter depends on the error represented by one pulse.

f) Describe construction of bimetallic thermometer.

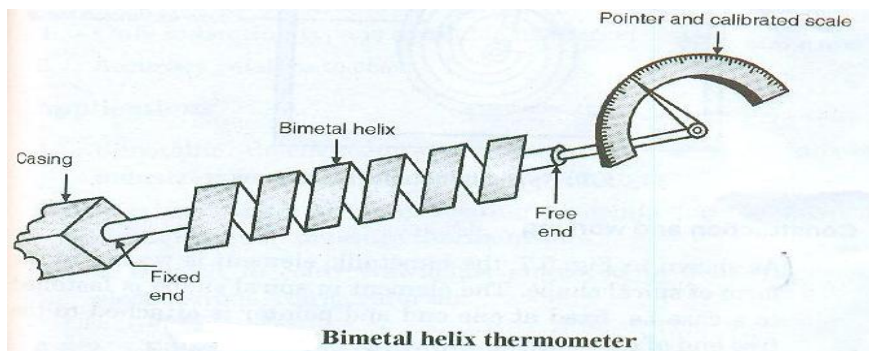
Ans. (Any one type of Bimetallic Thermometer) (Diagram – 2 Marks, Explanation – 2 Marks)



### Construction and working :

- Figure shows construction of bimetallic thermometer, it consists of bimetallic strip usually in the form of a cantilever beam, which is prepared from two thin strips of different metals having different coefficient of thermal expansion.
- The bonding of two strips is done by welding such that they can not move relative to each other.
- Brass is used as a high expansion metal and Invar (alloy of iron-nickel) is used as low expansion metal.
- As the temperature applied to the strip increases, there is deflection of the free end of the strip as shown in figure. The length of metal will change according to the individual expansion rate.
- As one end of bimetallic strip is fixed, the strip will bend at free end towards the side that of low coefficient of thermal expansion metal.
- The deflection of the free end is directly proportional to the square of the length of the metal strip, as well as to the total change in temperature, and is inversely proportional to the thickness of the metal.
- Pointer is attached to the free end to indicate the temperature.

OR



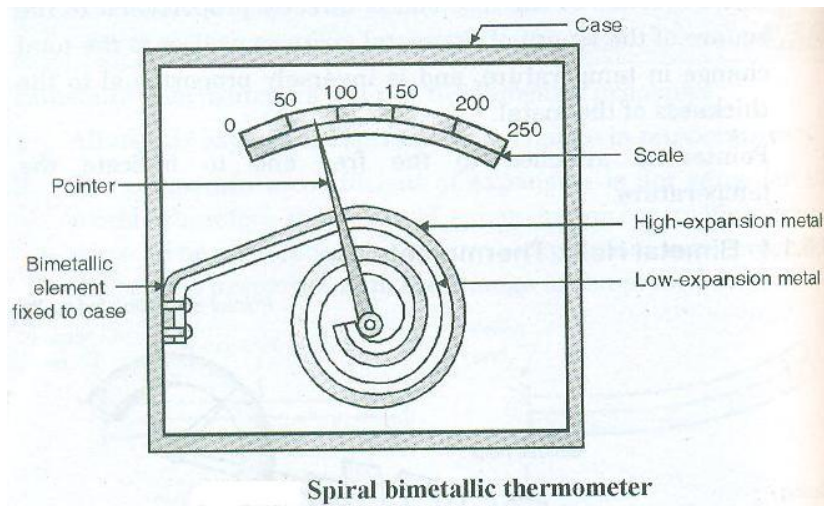
### Construction and working :

- Figure shows construction of bimetal helix thermometer. The sensitivity of simple strip type thermometer is improved by using a longer strip in a helical shape. The element is in a protective sheath.
- One end of the strip is fixed to the casing and other is free and conveniently connected to the pointer. The pointer scale assemble gives the read.
- The pointer sweeps over a circular dial graduated in degrees of temperature.

- As the temperature change, the bimetal expands and the helical bimetal rotates at its free end also moves the pointer to a new position on the scale.

**OR**

### Spiral Bimetallic Thermometer



#### Construction and working :

- As shown in figure, the bimetallic element is wound in the form of spiral shape. The element in spiral shape is fastened to a case i.e. fixed at one end and pointer is attached to the free end of element.
- Calibrated scale is provided for indicating temperature. Total assembly is encapsulated in housing.
- As the temperature increases the spiral coil element is tightened. As it coils, counterpost rotates clockwise, thus the pointer attached to the post also moves on a calibrated scale.
- This type of thermometer is used in homes and offices for indicating ambient temperature.

**Q4. Attempt any FOUR of the following :**

**(16M)**

**a) State working principle of capacitive type level sensor with diagram.**

**Ans. (Diagram – 2 Marks, Working Principle – 2 Marks)**

**Principle of working :**

The capacitive level detector operates on the equation of parallel plate capacitor, i.e.

$$C = \epsilon A/d$$

Where, C = capacitance value in farad

$\epsilon$  = dielectric constant

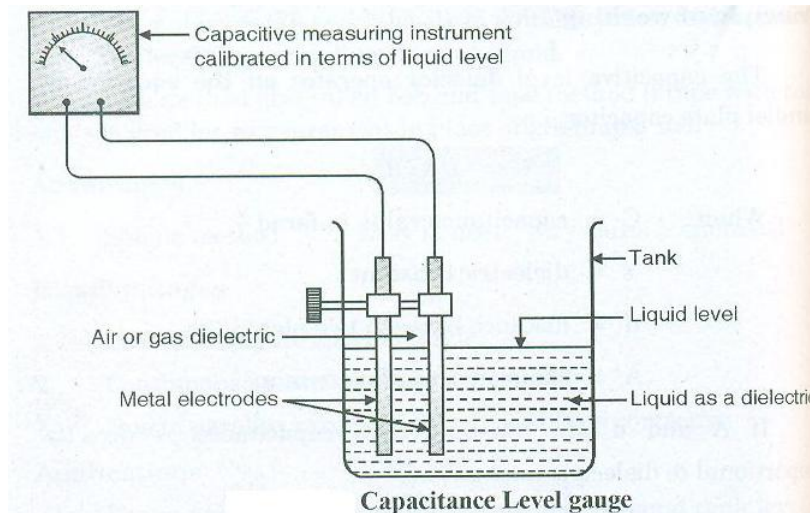
d = distance between two plate in m

A = common area of plate in m<sup>2</sup>.



If A and d are constant then capacitance is directly proportional to dielectric constant i.e.  
 $C \propto \text{dielectric constant } (\epsilon)$ .

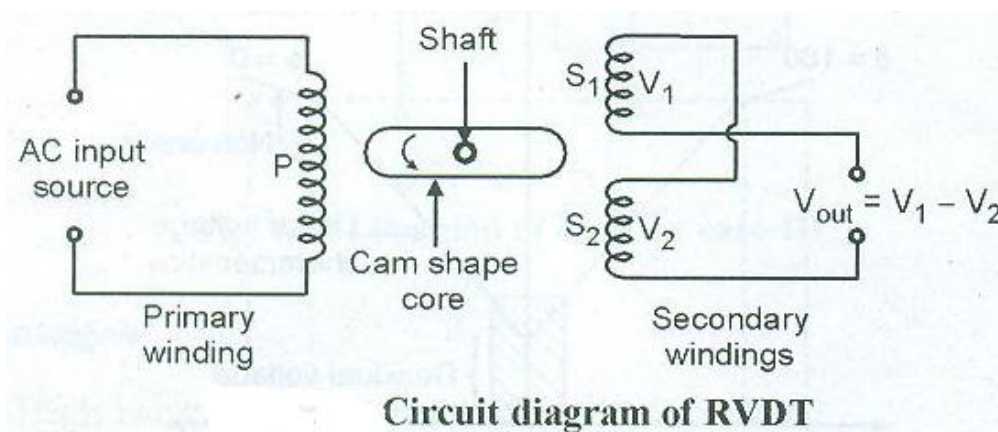
This principle is used in the capacitance level gauge for detecting level change.



**b) Draw and describe constructional diagram of RVDT.**

**Ans. (Diagram – 2 Marks, Explanation – 2 Marks)**

Rotary Variable Differential Transformer (RVDT) is inductive transducer, which converts the angular displacement into electrical signal.



**Construction and working :**

- Figure shows the circuit diagram of RVDT which is similar to that of LVDT except the cam shaped core and it is rotated between the winding with the help of shaft. The operation is similar to the LVDT.
- If there is no angular displacement to the core i.e. null position, the output voltage of secondary windings  $S_1$  and  $S_2$  are equal and in opposition. Hence output voltage is zero.
- If the core rotates in anticlockwise direction it produces more voltage in winding  $S_1$  and  $S_2$ . Hence output is

$$V_o = V_{s1} - V_{s2}$$

- If the core rotates in clockwise direction it produces more voltage in winding  $S_2$  than  $S_1$ .

Hence output is

$$V_o = V_{s2} - V_{s1}$$

- Thus by using RVDT one can determine the angular displacement and its direction.

**c) State Seeback and Peltier effect.**

**Ans. (Seeback – 2 Marks, Peltier – 2 Marks)**

**Seeback effect :**

Seeback effect state that whenever two dissimilar metals are connected together to form two junctions, out of which, one junction is subjected to high temperature and another junction is subjected to low temperature then emf is induced proportional to the temperature difference between two junctions.

**Peltier effect :**

Peltier effect state that for two dissimilar metals closed loop, if current forced to flow through the closed loop then one junction will be heated and other will become cool.

**d) List non contact type transducer and compare them on the basis of any two factors.**

**Ans : (Types 2M, Comparison 2M )**

**List non contact type transducer**

**1. Magnetic pick-up**

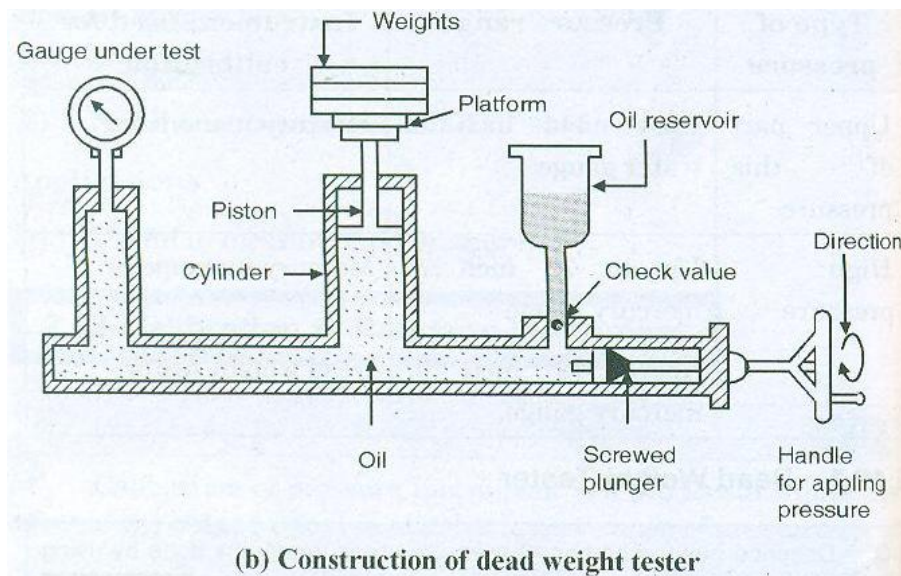
**2. Photoelectric**

Sr. No.	Magnetic pick-up	Photoelectric
1	This tachometer generator consists of a metallic tooth rotor mounted on the shaft whose speed is to be measured.	This method of measuring speed of rotation consists of mounting an opaque disc on the rotating shaft.
2	A magnetic pick-up is placed near the toothed rotor. The magnetic pick-up consists of a housing containing a small permanent magnet with a coil wound round it.	The disc has a number of equidistant holes on its periphery. At one side of the disc a light source is fixed like LED and on other side of the disc, and on the line of the light source, a light sensor like phototube or some photosensitive semi conducting device is placed.

3	Since the number of teeth is known the speed of rotation can be determined by measuring the frequency of pulses with an electronic counter.	$N = f/H_N$ Since the number of holes on the disc is fixed, the speed is a function of pulse rate.
4	A typical rotor has 60 teeth thus if the counter counts the pulses in one second, the counter will directly display the speed in rpm.	The pulse rate can be measured by an electronic counter which can be directly calibrated in terms of speed in rpm.

e) Draw labeled dead weight tester.

Ans. (Diagram – 4 Marks)



f) List applications of thermocouple and thermistors.

Ans. (any 2 applications) (Thermocouple – 2 Marks, Thermistors – 2 Marks)

**Applications of Thermistors:**

1. Widely used in the applications of the range from - 60°C to + 15°C.
2. Used as a sensor in liquid level, pressure, flow measurement systems.
3. Used for measurement of power at high frequency.
4. It is used for temperature control, temperature compensation, and time delay circuits.

**Applications of Thermocouple:**

1. It is used in industrial furnaces.
2. It is used for temperature measurement in cryogenic range.
3. It is used for flow measurement.

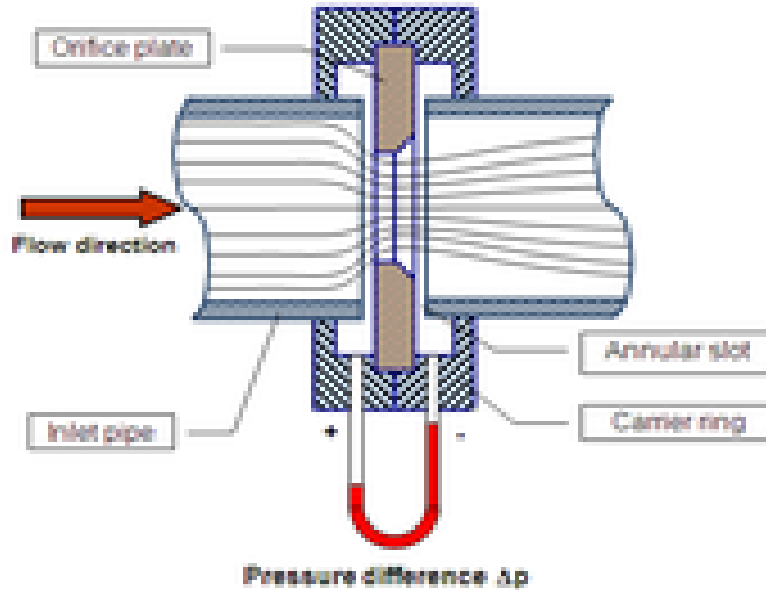
Q5) Attempt any FOUR of the following.

16M

a) Describe the construction of orifice plate flow meter.  
[2 marks for dia. And 2 marks for explanation]

Ans:

It is variable head flow meter in which the differential pressure is developed by using orifice plate by inserting it in the path of the fluid flow.



Orifice meter is as shown in fig

Pressure difference is measure between two sections 1&2. The arm at inlet of the manometer is located at a distance far away from the orifice plate whereas the other arm is at nearby distance of the other side of orifice plate. U tube manometer is used for measurement of differential pressure. Thus differential pressure ( $p_1-p_2$ ) is directly proportional to the flowrate.

b) Calculate the output resistance of PT100 RTD for temperature value 35°C and 85°C.[2 marks for each]

Given data:

a)

$$R_0 = 100\Omega \quad t_0 = 0^\circ\text{C}$$

$$R_2 = ? \quad t_2 = 35^\circ\text{C}$$

Assume  $\alpha$  (for platinum) = 0.0039

Relation between resistance and temperature for resistance thermometer is,

$$R_1 = R_0(1 + \alpha\Delta t)$$

$$R_1 = 100[1 + 0.0039(35)]$$

$$R_1 = 100[35.136]$$

$$R_1 = 113.65\Omega$$

Resistance at 35°C is 113.65Ω.

b)

$$R_0 = 100\Omega \quad t_0 = 0^\circ\text{C}$$

$$R_2 = ? \quad t_2 = 85^\circ\text{C}$$

Using same above formula and calculations.

$$R_2 = R_0(1 + \alpha\Delta t)$$

$$R_2 = 100[1 + 0.0039(85)]$$

$$R_2 = 100[1.3315]$$

$$133.15\Omega$$

Resistance at 85°C is 133.15Ω.

**c) Write example of each type**

- 1) primary transducer
- 2) Active transducer
- 3) Electrical transducer
- 4) Digital transducer

Ans [ 1 mark for each]

- 1) primary transducer – Bourdon tube
- 2) Active transducer- Thermocouple, Piezoelectric
- 3) Electrical transducer- Strain gauge, Electromagnetic flow meter
- 4) Digital transducer- Rotary encoder

**d) List two applications and two advantages of ultrasonic flow type transducer**

[ 2 marks for application and 2 marks for advantages, any 2 points]

Ans Applications

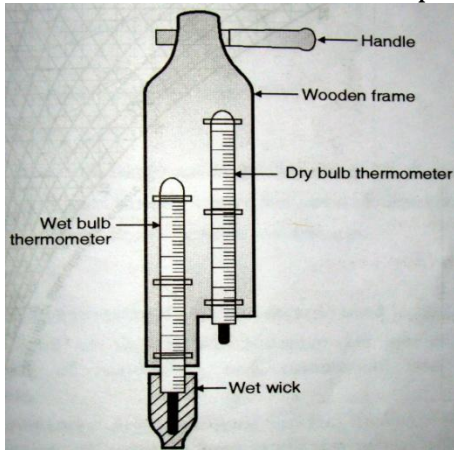
- 1) Mostly used for liquid without any pressure loss.
- 2) Mainly used for liquid flow.

Advantages

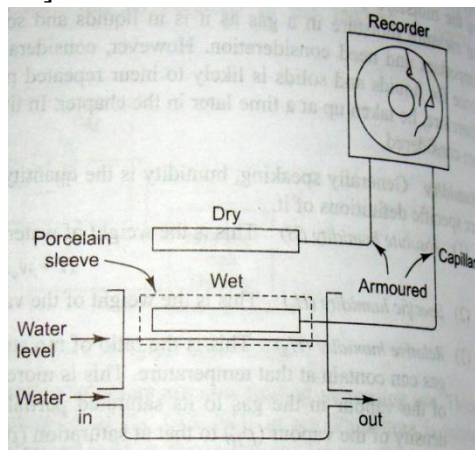
- 1) Good accuracy
- 2) Fast response
- 3) No moving part.

**e) Describe the Working of dry and wet bulb thermometer**

[2 marks for dia. And 2 marks for explanation]



OR



Explanation:

1. Figure shows the construction of dry and wet bulb thermometer. It consists of two thermometers one of which has wet bulb and the other dry bulb thermometer.
2. Wet bulb thermometer is covered with muslin sleeve which is kept moist with distilled and clean water , in this way the wet bulb is constantly kept wet which measures wet bulb temperature. The dry bulb thermometer measures dry air temperature
3. The thermometers are attached to a handle or length of rope and spun around in the air for a few minutes
4. Evaporation from the wet bulb lowers the temperature so that the wet bulb thermometer usually shows a lower temperature than that of the dry bulb thermometer.

5. However, when the air temperature is below freezing point it is possible for the wet bulb to be warmer than the dry bulb.
6. Relative humidity is computed from the ambient temperature as shown by dry bulb thermometer and difference is shown by the wet bulb & dry bulb thermometers.
7. Relative humidity can be determined by locating the intersect point of wet & dry bulb temperatures on a psychrometric chart.
8. The device that uses the wet /dry bulb method is called as sling type hygrometer.

**Q6) Attempt any FOUR of the following;**

**16M**

- a) **Which transducer is suitable for temperature measurement in industries? list units of temperature and shows its conversion procedure.**

[1 marks for name and 1 for conversion (any three)]

Ans

1. Bimetallic transducer
2. Radiation pyrometer
3. Thermocouple
4. RTD

**Temperature scales:**

1. Fahrenheit temperature scale: (°F)

$$^{\circ}\text{F} = (9/5)^{\circ}\text{C} + 32$$

2. Celsius temperature scale: (°C)

$$^{\circ}\text{C} = (5/9) * (^{\circ}\text{F} - 32)$$

3. Kelvin temperature scale: (°K)

$$^{\circ}\text{K} = ^{\circ}\text{C} + 273.15$$

4. Rankine temperature scale: (°R)  
Relation between °R & °F is given by,

$$^{\circ}\text{R} = ^{\circ}\text{F} + 459.69$$

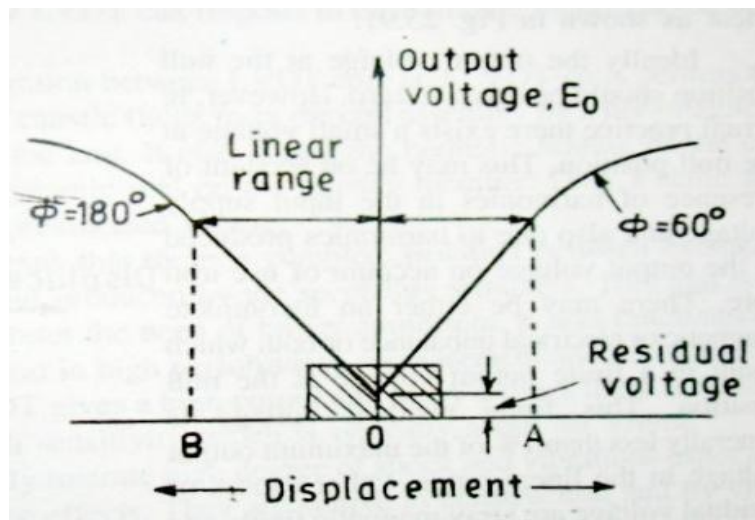
5. Relation between °R & °K is given by,

$$^{\circ}\text{R} = (9/5)^{\circ}\text{K}$$

Reaumur temperature scale: (°R')

- b) **Draw the characteristics of LVDT and compare LVDT and RVDT with any two points.** [ 2 marks for characteristics and 2 marks for comparison]

Ans



Parameter	LVDT	RVDT
Displacement	Linear displacement	Angular displacement
Core movement	Left to right to measure voltage	Core rotated clockwise to measure voltage

c) Compare variable head flow meter with variable area flow meter. (four points) [ 1 mark for each]

Ans

Variable head and variable area flow meter (1 mark for each point)

Parameter	Variable head flowmeter	Variable area flowmeter
Working principle	Restriction or obstacle is placed in the path of flow it produces differential pressure	The pressure difference is kept constant by changing the restriction area.
Construction	Circular shape of plate with a hole is inserted inside the pipe or throat is used to produce differential pressure across the plate	Tapered transparent glass tube with small diameter at bottom and float is inside the tube.
Maintenance cost	less	less
Use	Used in viscous fluid ,slurries and dirty fluids.	In laboratories and testing and production lines.

d) Describe the need of level measurements. [ 4 marks for description]

Ans

In almost all industries, vast quantities of liquid such as water ,solvents, chemicals etc. are used in number of processes. It is widely employed to

monitor as well as measure quantitatively the liquid content in the tanks, containers and vessels etc liquid level affects both pressure and rate of flow in and out of the container and therefore its measurement becomes important in a variety of processes encountered in modern manufacturing plants.

e) **List two advantages of capsule bellows.** [ 2 marks for each]

Ans

Advantages of capsule

1. High accuracy
2. Suitable for low pressure measurement.

Advantages of bellows

1. Good for low to moderate pressure range.
2. Adaptable for absolute and differential pressure.

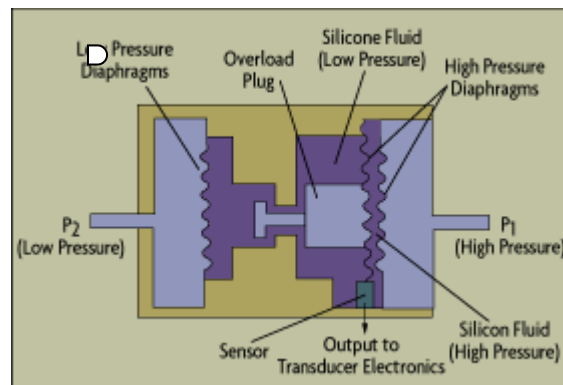
f) **How strain gauge is used for pressure measurement, explain?**

[2marks for dia. And 2 marks for explanation]

Ans

**strain gauge:**

- strain gauge is used for pressure measurement as one of the arm of a wheatstones' bridge, the pressure is applied to the strain gauge through diaphragm elastic pressure sensor.



OR

**Any relevant diagram should consider.**