



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 judgment 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:

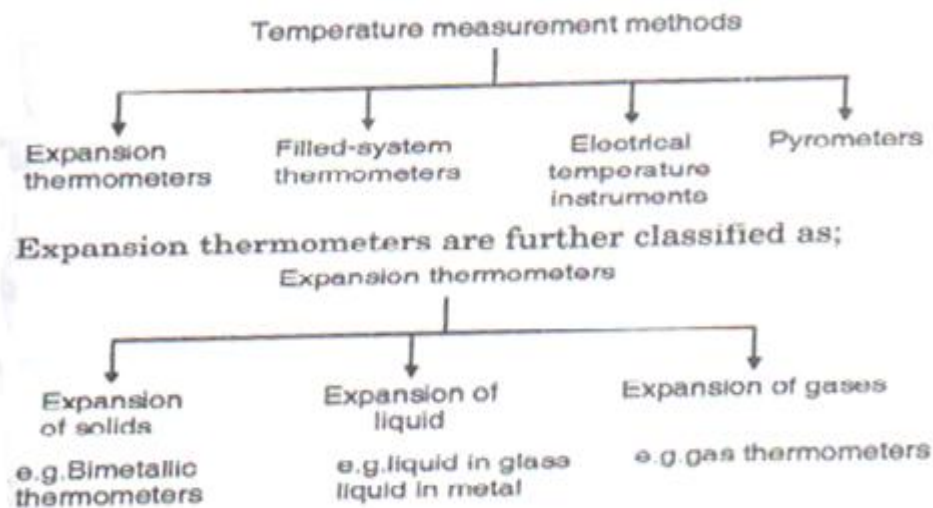
12M

(i) **Classify the temperature measuring transducers.**

NOTE:- [only list is enough sub classification may not require]

Ans: Classification of temperature transducers:

2M



OR



1. **Expansion thermometers:** ½ M
 - Bimetallic thermometers
 - Bimetal Helix Thermometer
 - Spiral Bimetallic thermometers

2. **Filled system thermometers:** ½ M
 - Liquid filled thermometers
 - Gas filled thermometers
 - Vapour pressure thermometers

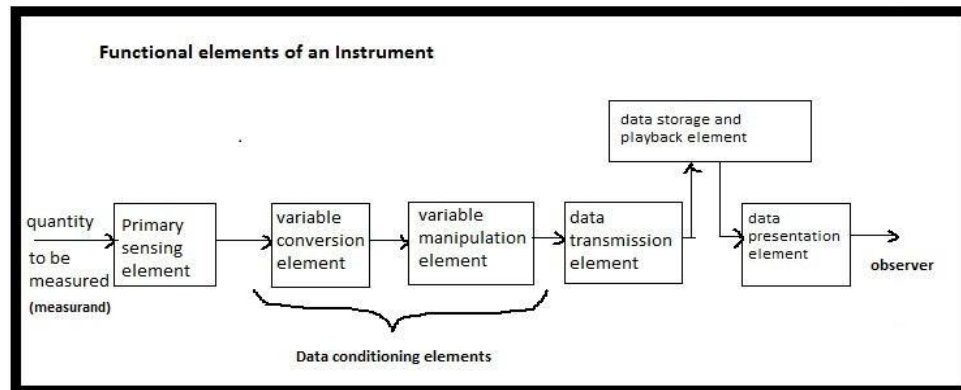
3. **Electrical Temperature Instruments:** ½ M
 - RTD
 - Thermistors
 - Thermocouples

4. **Pyrometers:** ½ M
 - Radiation Pyrometers
 - Infrared Pyrometers
 - Optical Pyrometers

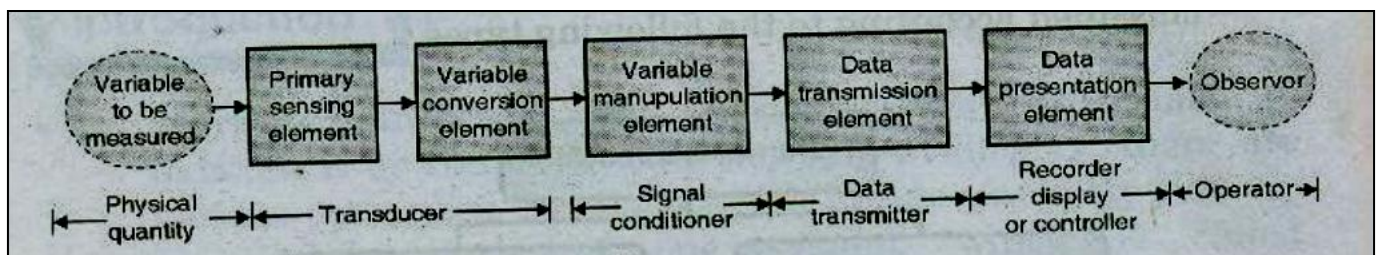
(ii) Draw the neat labeled block diagram of Instrumentation system.

Ans: **Diagram:**

2M



OR

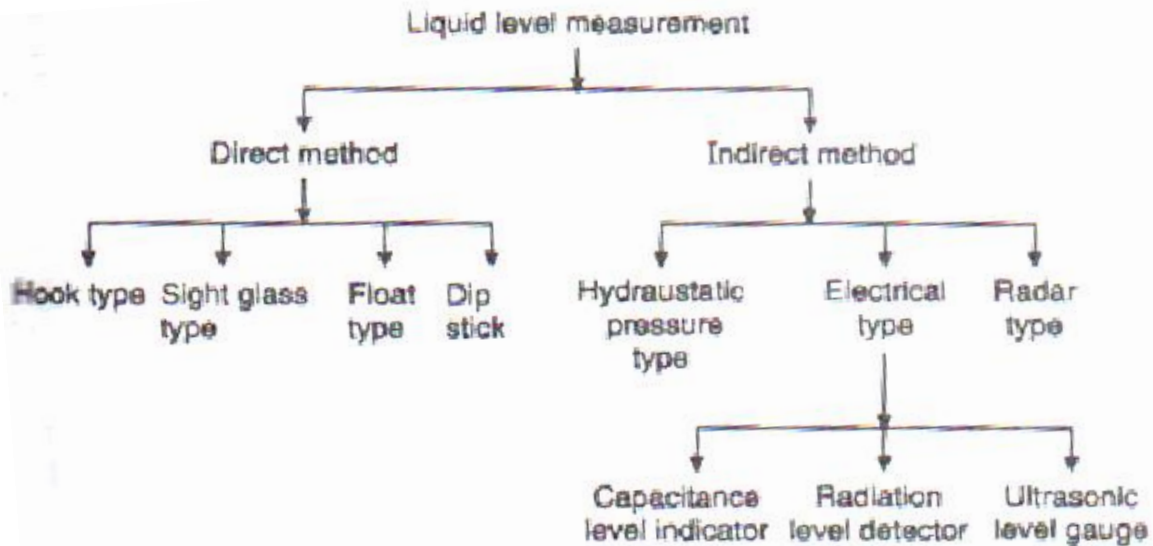




(iii) List different level measuring methods.

Ans:

2M



(iv) State Seebeck effect and Peltier effect.

Ans: Seebeck effect:

1M

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

Peltier effect:

1M

Peltier effect states 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.

(v) Identify active and passive transducers from the following:

- (i) RTD
- (ii) Strain gauge
- (iii) Thermocouple
- (iv) Piezoelectric Transducer

Ans:(i) RTD: Passive transducer

½ M

(ii) Strain gauge:Passive transducer

½ M

(iii) Thermocouple:Active transducer

½ M

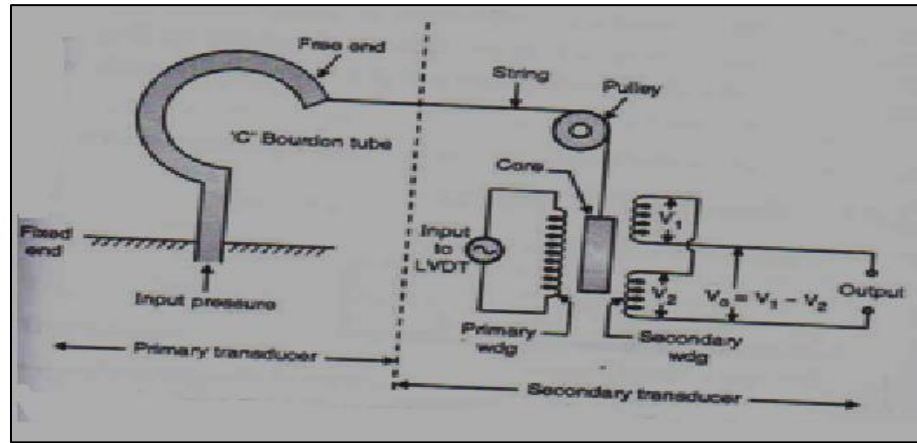
(iv)Piezoelectric transducer:Active transducer

½ M

(vi) Draw neat labeled diagram for pressure measurement using Bourdon tube and LVDT.

Ans: Diagram:

2M



(vii) Define Laminar and Turbulent flow on the basis of Reynolds number.

Ans: Laminar flow:

1M

If the Reynolds number is less than 2000, the flow is said to be Laminar flow.

Turbulent flow:

1M

If the Reynolds number is greater than 4000, the flow is said to be Laminar flow.

Where Reynolds number provides information about whether flow is Laminar flow or Turbulent flow.

(viii) Define absolute humidity and relative humidity.

Ans: Absolute humidity:

1M

- It is defined as a mass of water vapour present per unit volume.
- Absolute humidity = $\frac{\text{mass of water vapour}}{\text{mass of air}}$

Relative humidity:

1M

- It is defined as a ratio of moisture content of gas to the maximum moisture the gas can contain at that temperature.
- Relative humidity = $\frac{\text{mass of content of gas}}{\text{fully saturated air}}$

Q1 b) Attempt any TWO of the following:

8M

(i) State selection criterion of transducers.

Ans:

Any 8 points: 4M

1. Operating range
2. Operating principle
3. Sensitivity

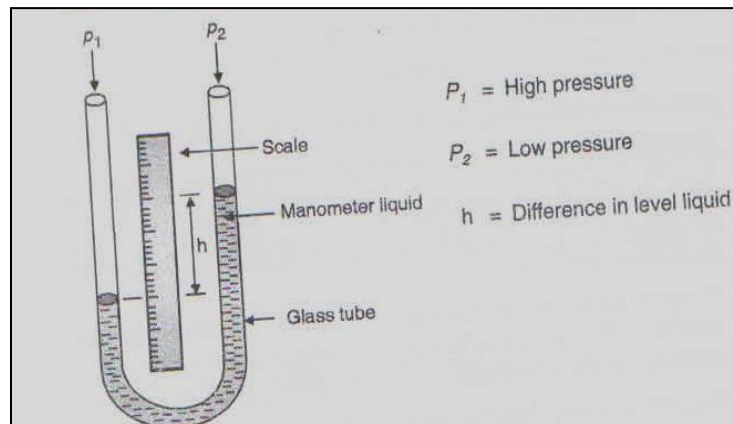


4. Accuracy
5. Frequency response and resonant frequency
6. Errors
7. Environmental compatibility
8. Usage and ruggedness.
9. Electrical aspect.
10. Stability and Reliability
11. Loading effect
12. Static characteristics
13. General selection criteria

(ii) Draw and describe working of U-tube manometer.

Ans: Diagram:

2M



Working:

2M

- When two pressures P_1 and P_2 are equal, the liquid height in manometer tube is at equal level in both limbs.
- If there is a pressure difference at two ends of tube, the liquid goes down on one side and goes up on other side.
- The relation of pressure with difference in height of liquid, is given by the equation,
 $P_1 - P_2 = \rho gh$
Where $P_1 - P_2$ = differential pressure,
 ρ = density of fluid in U tube manometer
 g = acceleration due to gravity.
 h = difference in height of liquid levels.
Therefore $h = (P_1 - P_2) / \rho g$
- The value of 'h' gives the differential pressure. Here $P_1 - P_2$ is a pressure difference.
- As ρ and g are constants, therefore $h \propto P_1 - P_2$
- If P_1 is known pressure then P_2 can be easily calculated with the help of manometer.



(iii) Classify thermocouples on the basis of

- (i) Type
- (ii) Material used
- (iii) Temperature range
- (iv) Sensitivity

Ans: [Note: Any Four]

1M each

SR. NO	THERMOCOUPLE TYPE	MATERIALS USED	TEMPERATURE RANGE/°C	SENSITIVITY $\mu\text{V}/^\circ\text{C}$
1	T	Copper/ Constantan	-200 to 400	15 -60
2	E	Chromel/Constantan	0 to 850	40 - 55
3	J	Iron/Constantan	-200 to 900	45 - 57
4	K	Chromel/Alumel	-200 to 1250	40 - 55
5	R	Platinum/Platinum 13% Rhodium.	0 to 1600	5 -12
6	S	Platinum/Platinum 10% Rhodium.	0 to 1500	5- 12
7	B	Platinum 6% Rhodium/ Platinum 30% Rhodium	30 to 1800	0.3- 0.8
8	G	Tungsten/ Tungsten 26% Rhenium	15 to 2800	3 - 20
9	C	Tungsten 5% Rhenium / Tungsten 25% Rhenium	0 to 2750	10 - 20

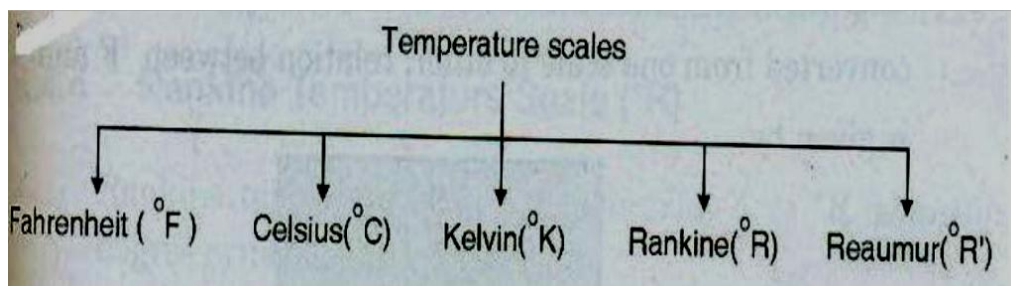
Q2. Attempt any FOUR of the following:

16M

a) List types of temperature scales. Write the ice point and boiling point of pure water in each scale.

Ans: Types of temperature scales:

2M





Ice point and boiling point of pure water in each scale:

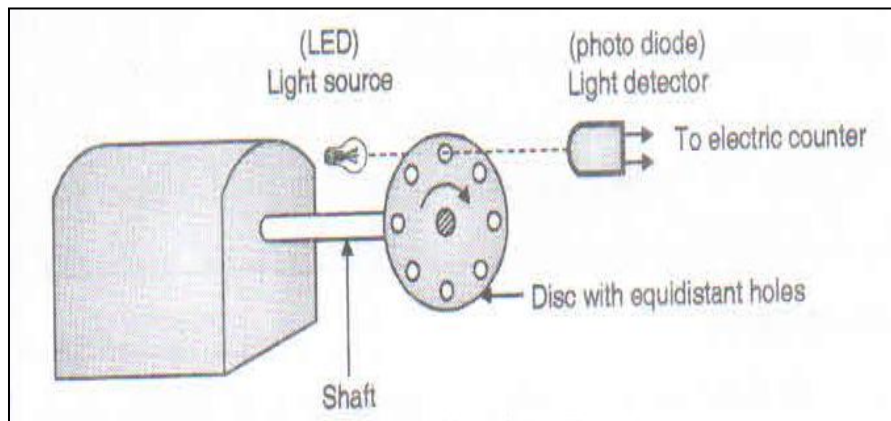
2M

Temperature scale	Ice Point	Boiling Point
Fahrenheit(°F)	32	212
Celsius(°C)	0	100
Kelvin(°K)	273.15	373.15
Rankine(°R)	491.7	671.7
Reaumur(°R')	0	80

b) Draw the construction and explain the working of photoelectric pickup type speed measuring transducer.

Ans: Constructional diagram:

2M



Working:

2M

- Working principle: The light passes through the holes available on the rotating disc with a specific interval, depends on the angular speed of disc having equidistant holes. The frequency of this light pulses is measure of angular speed of the disc.
- It consists of an opaque disc on the rotating shaft. 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 semiconducting device is placed.
- When a hole appears between two, the light following upon the sensor produces an output pulse.
- The frequency at which the pulses are produced depends on the number of holes in the disc and its speed of rotation. Hence the speed is given by

$$N = f / H_s$$

N = speed

f = frequency

H_s = holes on the disc

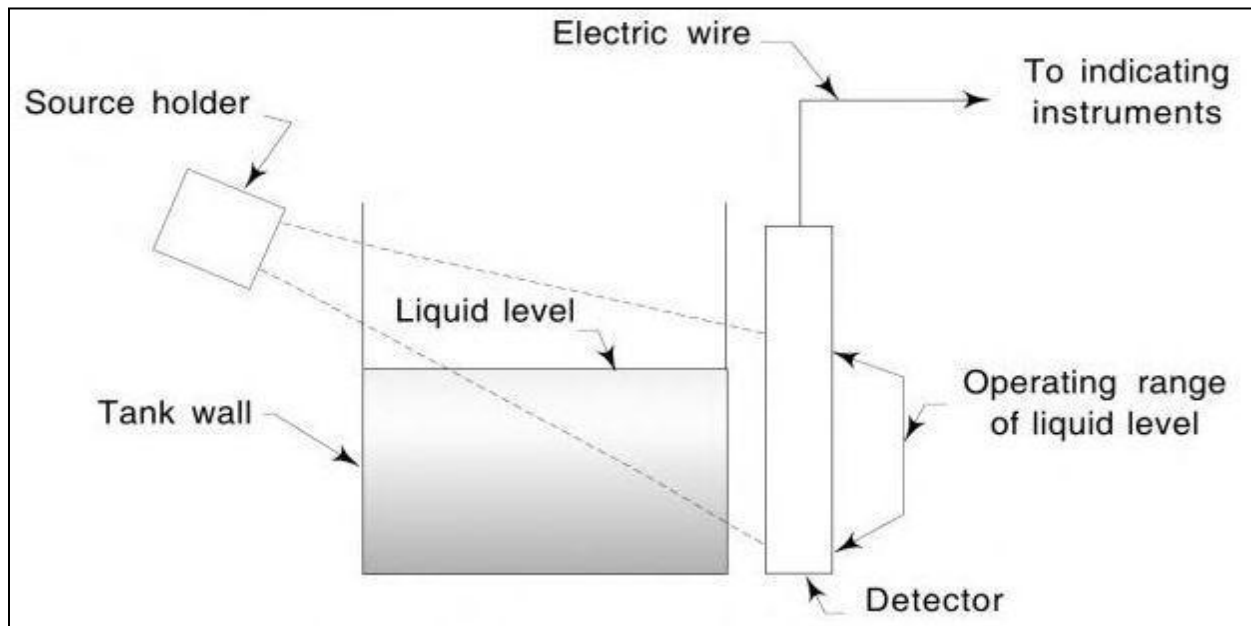


c) Explain working of radiation type level measuring transducer with its constructional diagram.

Ans:Diagram:

2M

Radiation level measurement is non-contact type liquid level measurement technique. Radiation detectors are used where other electrical methods would not survive.



Construction and working:

2M

- It consists of gamma ray source holder on one side of the tank and a gamma detector on the other side of the tank.
- The gamma rays from source are directed towards the detector in a thin band of radiation.
- When gamma rays penetrate the thick wall of the tank, its energy level afterwards is greatly reduced.
- The radiation received at the gamma detector is inversely proportional to the thickness of the walls and the medium between the radiation source and detector.
- The amount of radiation received is inversely proportional to the amount of liquid between the radiation source and detector.
- The difference in the amount radiation received by detector, corresponds to the liquid level in the tank.
- Thus, when liquid level rises, the amount of radiation received is reduced and vice versa.

d) Compare orifice plate and venture tube with reference to

(i) Working principle

(ii) Cost

(iii) Permanent pressure loss

(iv) Maintenance



Ans:

Each comparison: 1M

PARAMETER	ORIFICE PLATE	VENTURI TUBE
Working principle	It is the variable area flow meter in which differential pressure is developed by using orifice plate by inserting it in the path of fluid flow.	Venturi tube operates on the principle that when the restriction is placed in the path of flow, it produces differential pressure across the restriction which is proportional to the flow rate.
Cost	Low	High
Permanent pressure loss	High	Low
Maintenance	High	Low

e) Define active transducer and passive transducer. Give two examples of each.

Ans:Definition of Active transducer:

1M

Active transducers convert an input physical quantity into electrical output without any external supply. These transducers operate under energy conversion principle i.e. “the energy required for production of output signals obtained from physical quantity being measured”

Example: [Any two]

1M

Thermocouple, Piezoelectric transducer, photovoltaic cell, Tachogenerator.

1. Definition of Passive transducer:

1M

Passive transducers require external power supply to convert an input physical quantity into electrical output. These transducers operate under energy controlling principle i.e. “the energy required for production of output signals obtained from external power supply.

Example: [Any two]

1M

- Thermistors , Strain gauge, Potentiometers, Capacitive Transducer.

f) Define Pressure. Give the detailed classification of pressure measuring devices.

Ans:Definition of pressure:

2M

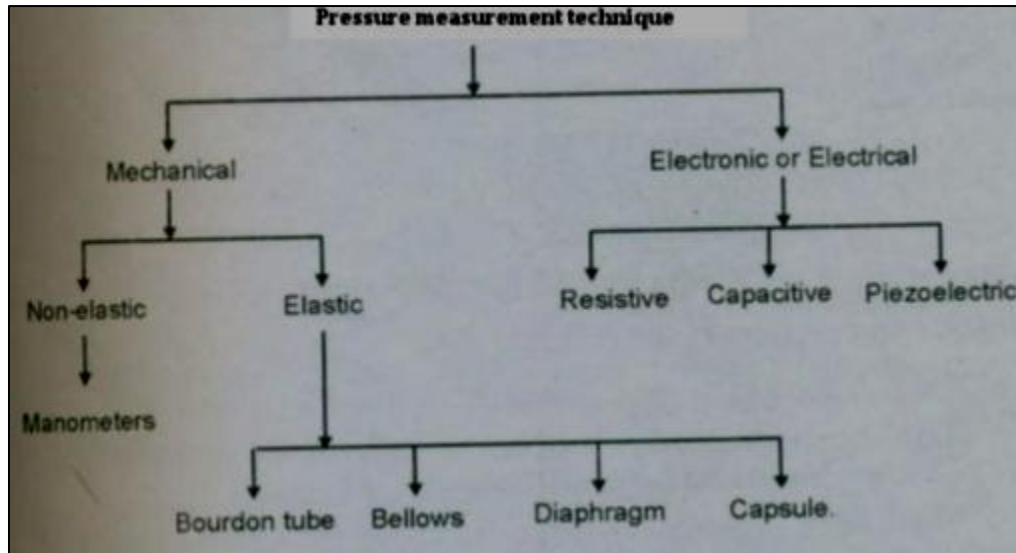
Pressure is defined as the amount of force applied to a surface or distributed over it and is measured as force per unit area.



• Pressure = $\frac{\text{Force (in Newton)}}{\text{Area (in Square Meter)}}$

- classification of pressure measuring devices.

2M



OR

- classification of pressure measuring devices.

- 1 .Non elastic Pressure transducer/manometer
 - i) U tube
 - ii) Well type manometer
 - iii)Inclined Type manometer
2. Elastic Pressure Tranducer/Mechanical
 - i) Bourdon tube
 - ii) Bellows
 - iii) Diaphragms
- 3.Electronics Pressure Transducer
 - i)Bourdon Tube with LVDT
 - ii)Diaphragms with Strain Gauge(Resistive)
 - iii)Capacitive, Piezoelectric

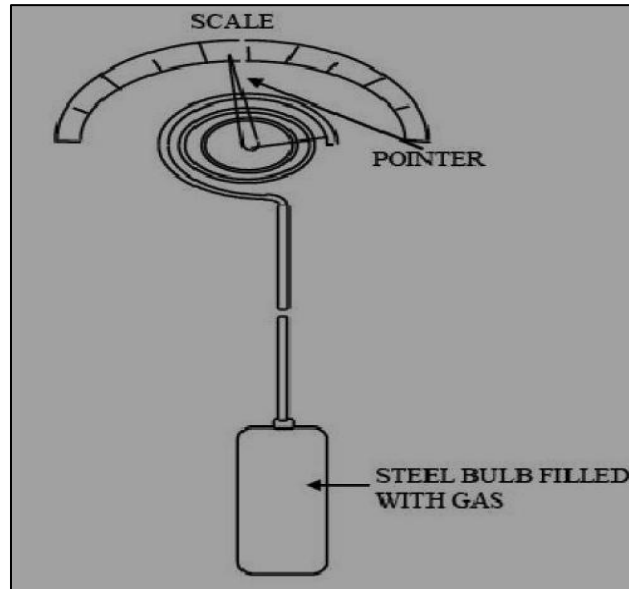
Q 3.Attempt any four of the following:

16M

- a) Name the gases used in gas filled thermometer. Explain its working with the help of suitable diagram.

Ans :-Diagram:

[Name 1M, Diagram 2M, Explanation 1M]



Explanation:

If volume of a gas is maintained at constant and If a certain volume of inert gas is enclosed in a bulb, capillary and bourdon tube, the most of the gas in the bulb, then the pressure increases with increase in temperature and that pressure is indicated by the bourdon tube may be calibrated in terms of the temperature of the bulb.

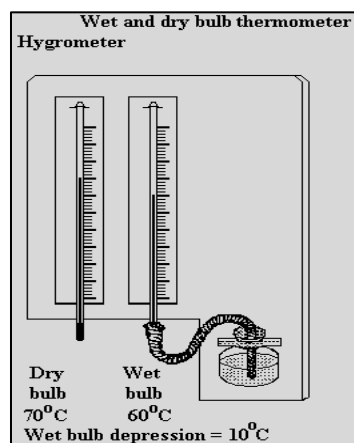
Name of the gases used in Gas filled thermometers. [Any two 1M]

1. Nitrogen
2. Helium
3. Inert Gas

b) With the help of suitable diagram, explain how humidity is measured with dry and wet bulb thermometer.

Ans:-Diagram

[Diagram 2M, Explanation 2M]





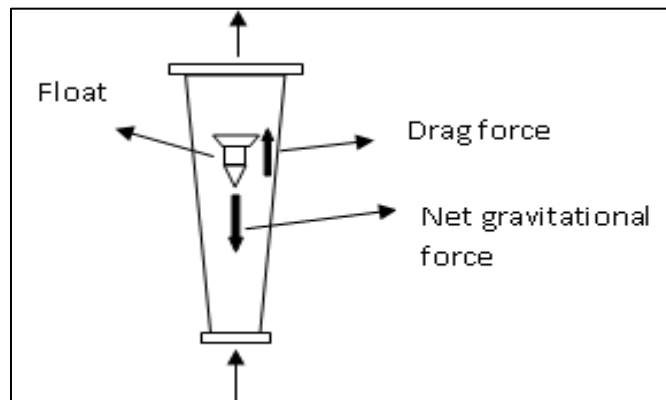
Explanation:-

- A psychrometer, or wet-and-dry-bulb thermometer, consists of two thermometers, one that is dry and one that is kept moist with distilled water on a sock or wick. The two thermometers are thus called the dry-bulb and the wet-bulb. At temperatures above the freezing point of water, evaporation of water from the wick lowers the temperature, so that the wet-bulb thermometer usually shows a lower temperature than that of the dry-bulb thermometer. When the air temperature is below freezing, however, the wet-bulb is covered with a thin coating of ice and may be warmer than the dry bulb.
- Relative humidity is computed from the ambient temperature as shown by the dry-bulb thermometer and the difference in temperatures as shown by the wet-bulb and dry-bulb thermometers. Psychrometers are commonly used in meteorology, and in the HVAC industry for proper refrigerant charging of residential and commercial air conditioning systems.

c) Draw the diagram of rotameter. State its four advantages and disadvantages.

Ans:-Diagram:

[Diagram 2M, four Advantages /disadvantages 2M]



• **Advantages of rotameter:**

1. Good range-ability
2. Low pressure drop
3. Can handle wide variety of corrosive fluids
4. Low cost.

• **Disadvantages of rotameter:**

1. Must be installed vertically.
2. Glass tube may be subject to breakage.
3. Limited to small pipe size.
4. Fair accuracy/

d) Compare RTD and thermistor with respect to

- i) **Size**
- ii) **Cost**
- iii) **Material of construction**
- iv) **Temperature Range.**



Ans:-

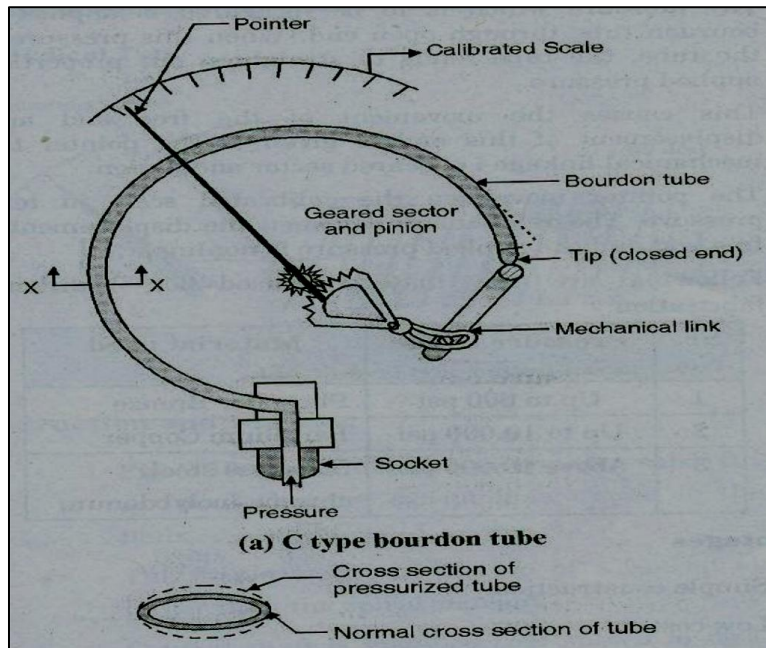
[1M each]

PARAMETER	RTD	THERMISTOR
Size	Large	Small
Cost	High	Low
Material Of Construction	Platinum, Copper, Nickel, Tungsten Etc.	Manganese, Copper, Cobalt, Iron Oxides Etc.
Temperature Range	-200 ⁰ C To 650 ⁰ c	-150 ⁰ C To 300 ⁰ c

e) Draw construction of bourdon tube pressure guage. List the materials used for the constructing the bourdon tube. State the types of bourdon tube.

Ans:-Diagram:

[Diagram 2M, List of materials 1M, Types 1M]



Material used for bourdon tube:

1. Phosphor bronze
2. Alloy steel
3. Stainless steel
4. Monel metal
5. Beryllium copper



Types of bourdon tube:

1. C-type
2. Helical type
3. Spiral type

f) List different methods of float type level measurement. Which material is used for float. State the need of level measurement in industries.

Ans: Methods for float measurement:

1M

[Note: No such methods are for float type level measurement, so appropriate marks should be given]

Materials used for float are Corrosion resisting material such as stainless steel. 1M

Need for level measurement

2M

Need for level measurement :-The level of liquid may affect both the pressure and the rate of flow in and out of the tank vessel, hence the quality may be affected. So, level measurement is an important parameter in industrial measurement system.

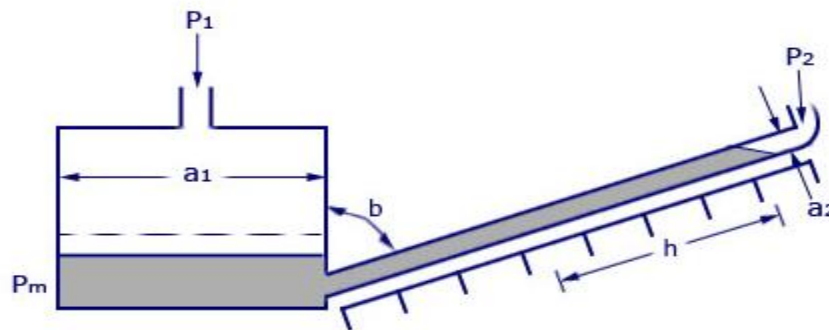
Q 4. Attempt any four of the following

[16M]

a) Draw neat labelled diagram of inclined tube and well type manometers. Write two advantages of each manometer.

Ans:-Diagram:

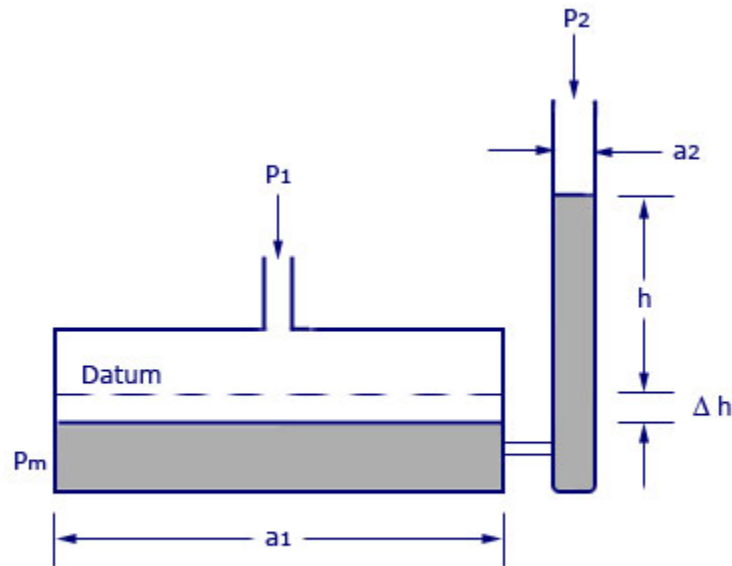
[Each Diagram 1M, advantages each 1 M (any 2 points)]



Inclined Tube manometer

Advantages:

1. High sensitivity and accuracy
2. Used to measure small pressure difference
3. Simple in construction



Well Type Manometer

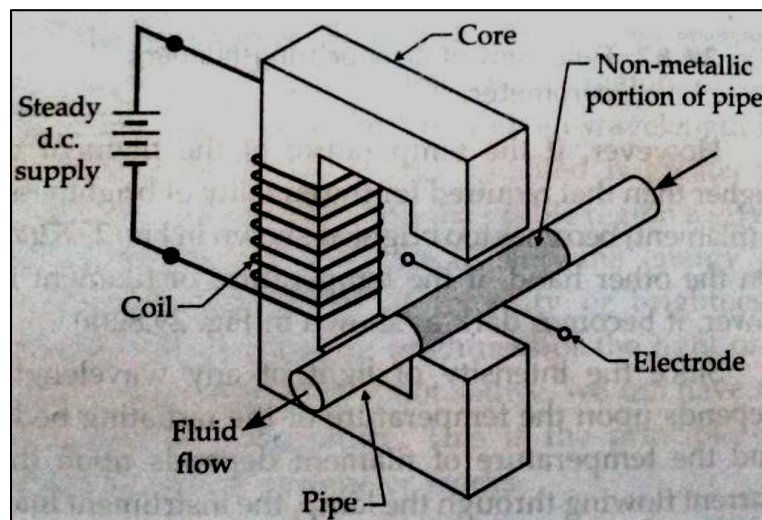
Advantages:

1. Simple in reading because of single leg.
2. Small error can be compensated because of large vessel.
3. Accurate when zero level is set before each reading.

b) Draw the neat labeled diagram of electromagnetic flow meter. Write two advantages and two applications of it.

Ans:- Diagram:

[Diagram 2M, Two advantages 1M, Two applications 1M]





Advantage: (Any Two)

- 1) Provides wide linear range.
- 2) Ability to measure reverse flow.
- 3) Gives rapid response to flow changes.
- 4) No obstruction is created to flow.
- 5) It can handle corrosive as well as slurry materials.
- 6) It has very low pressure drop.
- 7) Available in large size and capacity

Applications:[Any Two]

- 1) They are used where applications involving measurement of erosive/corrosive slurries.
- 2) They are employed in measuring paper stock or pulp, as well as low flow rates and pipe networks with relatively short inside diameters.
- 3) It is useful for electrically conducting fluid

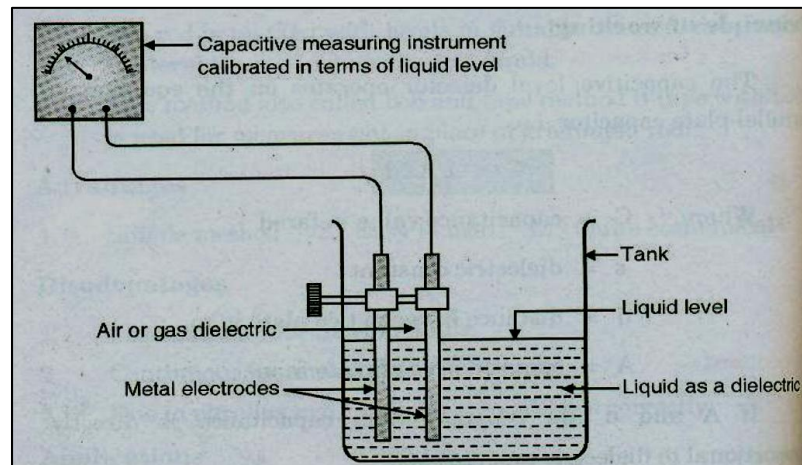
c) With neat labelled diagram, explain working of capacitance type level measurement.

Ans:-

[Diagram 2M, Explanation 2M]

- It consists of two probes firmly fixed parallel to each other and acts as plates of capacitor. This system is used for non-conducting liquid which act as an dielectric material.
- A capacitance measuring instrument is connected to the probes to measure the capacitance and it is calibrated in terms of liquid level in the tank.

Diagram:

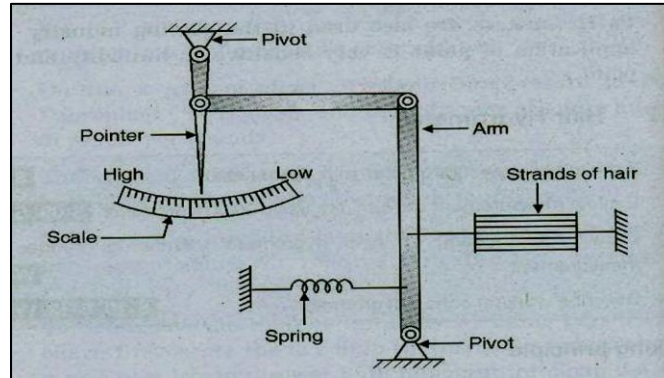


- When the liquid in the tank increases, the capacitance also increases and when the liquid level decreases the capacitance decreases.
- This value of capacitance is measured by capacitance measurement instrument and displayed on the indicator calibrated in terms of liquid level.

d) Draw the construction and explain the working of hair hygrometer.

Ans:- Diagram:

[Diagram 2M, Explanation 2M]



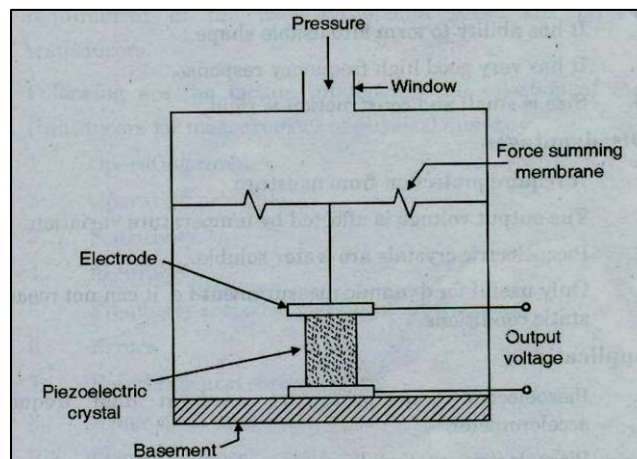
Explanation:

- It consists of bunch of human hair which increases mechanical strength of the instrument, arm with pivot joints and points scale assembly.
- The element is maintained at slight tension by a spring. The hair strands are generally arranged parallel to each other with sufficient space between them for giving free access to the air sample whose humidity is to be measured.
- The indicator scale is directly calibrated to give a direct indication of humidity. The pointer or recording pen is operated through mechanical linkage.
- As the relative humidity surrounding to that of hygrometer increases, length of hair strands increases, which move the pointer on the calibrated scale for maximum value.

e) With neat sketch state the working principle of piezoelectric transducer.

Ans: Diagram:

[Diagram 2M, Explanation 2M]



- **Working Principle:** When a pressure or force or vibration applied to the crystalline material like quartz crystal or crystalline substances then an e.m.f. is generated across the material or vice versa.



f) A Pt-100 type RTD has $\alpha = 0.00392 / ^\circ\text{C}$. Find its output resistance for temperature 25°C and 80°C .

Ans:-

[Formula 1M, Correct answers 3M]

Q. 4

f) For PT-100 $R_0 = 100\ \Omega$ $t_0 = 0^\circ\text{C}$

$$\alpha = 0.00392 / ^\circ\text{C}$$

Relation between resistance & temperature for resistance thermometer is.

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

i) Resistance at 25°C

$$R_t = 100 (1 + 0.00392 \times 25)$$

$$R_t = 109.8\ \Omega$$

ii) Resistance at 80°C

$$R_t = 100 (1 + 0.00392 \times 80)$$

$$R_t = 131.36\ \Omega$$

Q.5. Attempt any FOUR of the following:

16M

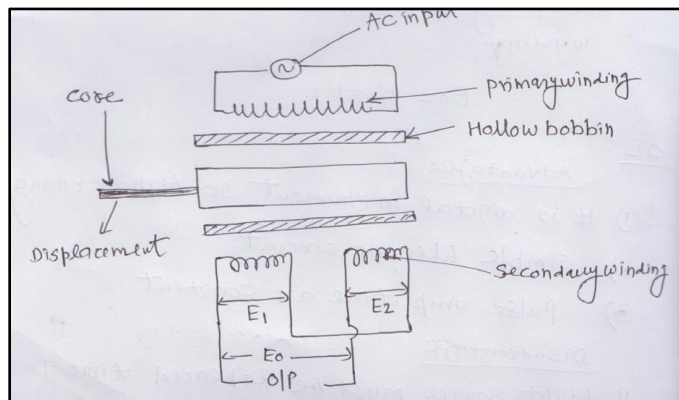
a) What is LVDT? Draw and describe construction of LVDT.

Ans: (Defination 1M, Diagram-1 M, construction-2M)

Explanation-

LVDT is the example of inductive transducer, in LVDT any physical displacement of the core cause the voltage of any secondary winding to increase while simultaneously reducing the voltage in the other secondary winding. The difference of the two voltages appears across the output terminal of the transducer and gives a measurement of the physical position of the core.

Construction of LVDT:





- A differential transducer consists of a primary winding and two secondary windings.
- The windings are arranged concentrically and next to each other.
- They are wound over a narrow bobbin which is usually of a non-magnetic and insulating material.
- A core in the shape of a rod is attached to the transducer sensing a shaft.
- An AC source is applied across the primary winding and core varies the coupling between it and two secondary windings.

$$\therefore E_0 = E_1 - E_2$$

b) State the advantages and disadvantages of photoelectric pick-up type speed measuring transducer.

Ans: (Advantages- 2 M, Disadvantages- 2 M, Each Point-1 M)

• Advantages (any 2 points)

- 1) It is a digital instrument so high accuracy.
- 2) Simple electric circuit
- 3) Pulse amplitude is constant

• Disadvantages (any 2 points)

- 1) Light source must be replaced time to time.
- 2) The accuracy depends on the error represented by one pulse.
- 3) High cost

c) Convert the 40 °C temperature into Fahrenheit and Rankine scale.

Ans: (Fahrenheit and Rankine scale- 2 M each)

Given: 40 °C

1) Fahrenheit

$$\frac{0C}{100} = \frac{F-32}{180}$$
$$\therefore \frac{40}{100} = \frac{F-32}{180}$$
$$\frac{4 \times 180}{100} = F-32$$
$$72 = F-32$$
$$72+32 = F$$
$$\underline{F = 104}$$

2) Rankine

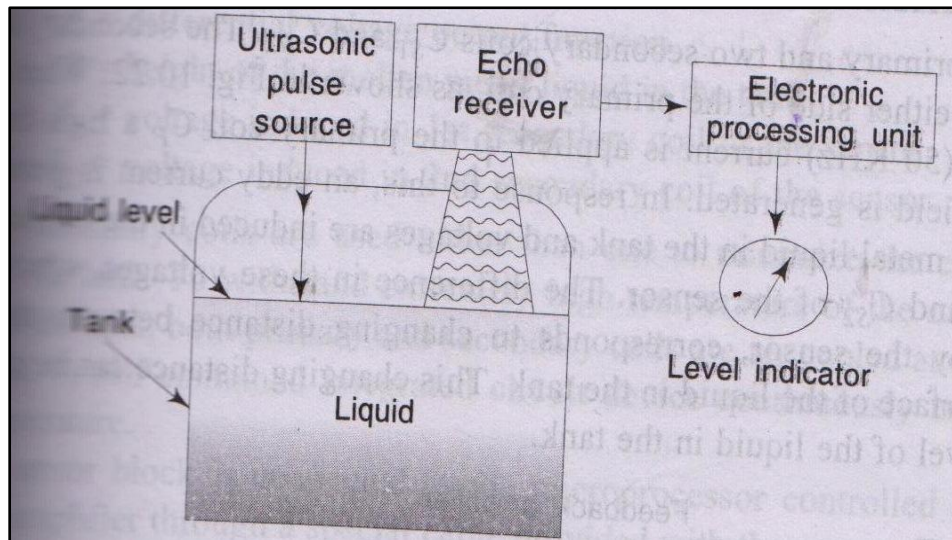
$$OR = 0F + 459.69$$
$$= 104 + 459.69$$
$$OR = 563.69$$



d) Describe the working principal of ultrasonic method of level measurement with neat sketch. State any two advantages and disadvantages.

Ans: (Diagram 1M working principal 1 M, two advantages 1M and two disadvantages 1M)

Diagram: [any other relevant diagram can be considered]



Working Principal:

- It operates by generating an ultrasonic pulse and measuring the time it takes for the echo to return.
- When an ultrasonic transmitter is mounted at the top of the tank.
- Since the angle of reflection is equal to the angle of incidence
- It is important that the reflecting surface be flat.

The time “t” between the transmitting and receiving a pressure pulse is proportional to the distance between the ultrasonic set and the surface of the content of the tank.

• **Advantages:**

- 1) They have no moving parts.
- 2) Used for both solid and liquid level measurement.
- 3) It is a non-disturbance technique.

• **Disadvantages:**

- 1) Complicated design
- 2) Temperature compensation is required
- 3) The dirt affects the accuracy of the measurement.

e) List different types of flow measuring transducers. Sketch the construction of venturimeter.

Ans: (List different types 2M, Diagram 2M)

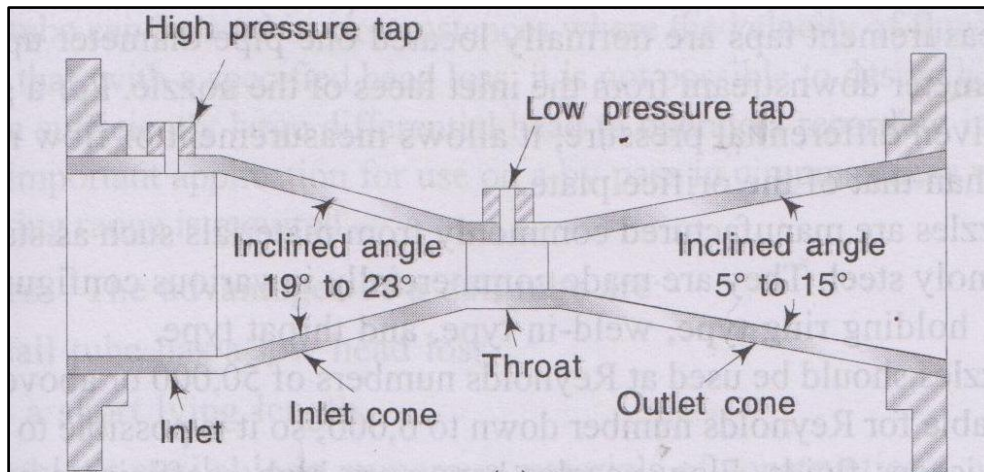
Different types of flow measuring transducers:

- Variable head meter or differential meter.
- Variable area meter



- Magnetic meter
- Turbine meter
- Ultrasonic flow meter
- Electromagnetic Flow meter

Diagram of venturimeter:

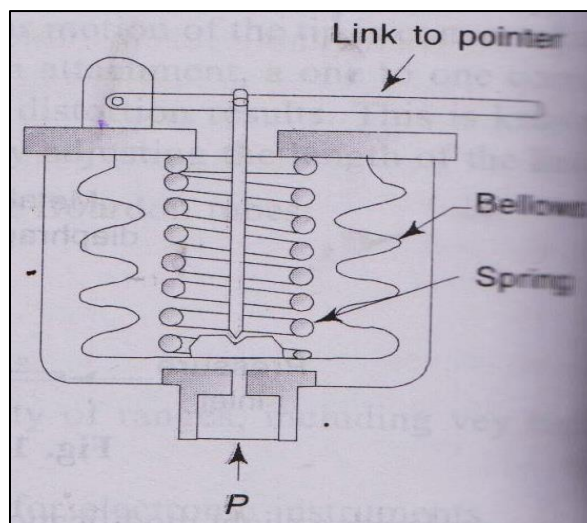


f) Draw the neat sketches of the following and state their working principal.

- Bellows
- Capsule

Ans: (Each Diagram-1M, Each working principal- 1M each)

i) **Bellows:**



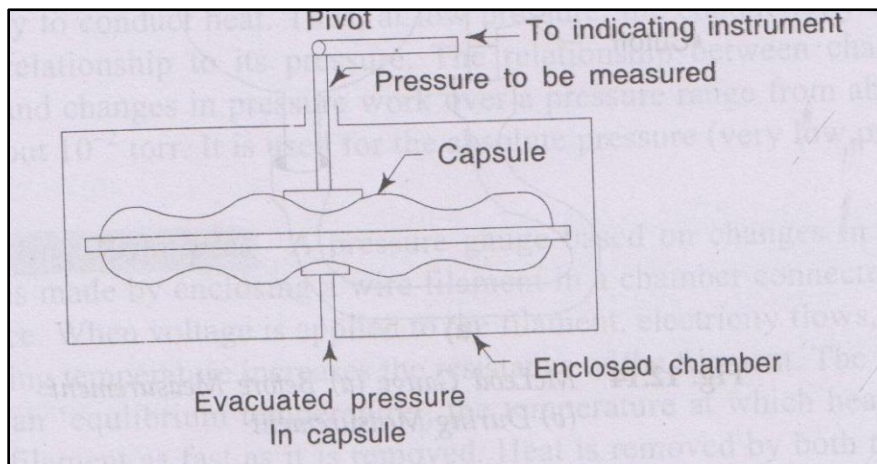
Working principal:

- 1) When pressure is applied to one side of the bellows and the resulting deflection is counter balanced by a spring.



- 2) This arrangement indicates the gauge pressure
- 3) Pressure acting on the outside of the bellows compresses the bellows and moves its free end against the opposing force of the spring.

ii) Capsule:



Working principal:

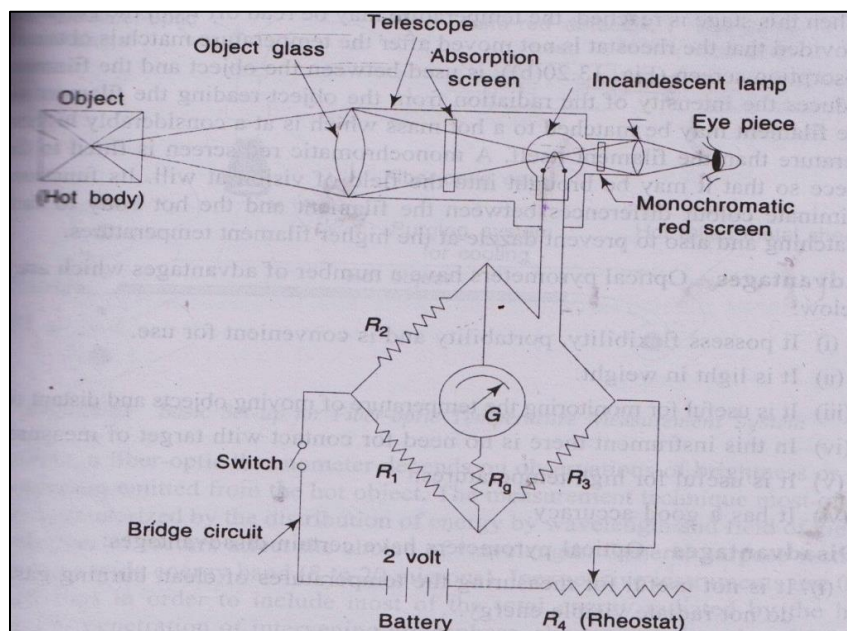
- 1) The capsule is evacuated and sealed
- 2) The measured pressure is admitted to the inside of the instrument case which is of air tight structure
- 3) Pressure variation causes the capsule dimension to change, which is transmitted via mechanical linkages to a rotary pointer.

Q 6. Attempt any FOUR of the following: [16M]

a) Describe the working principal of optical pyrometer with neat diagram.

Ans: (Diagram-2½M, working principal -1½ M)

Diagram:



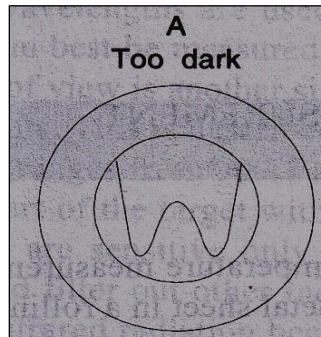


Principal:

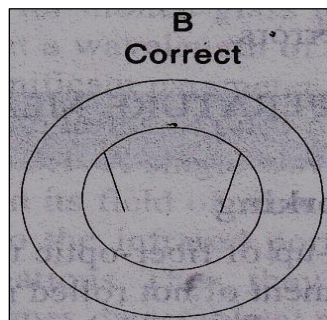
Operation of optical pyrometer based on the comparison of the intensity of the visual radiation emitted by the hot body with the radiation emitted by the source of known intensity.

Working:

The hot object is viewed through the telescope when the filament first appears as a dark line against the glowing background as shown at A



On rotating the Rheostat the temperature of the filament is progressively increased until the visible radiation matches that of the hot object when the tip of the filament becomes invisible against the block ground as shown at B

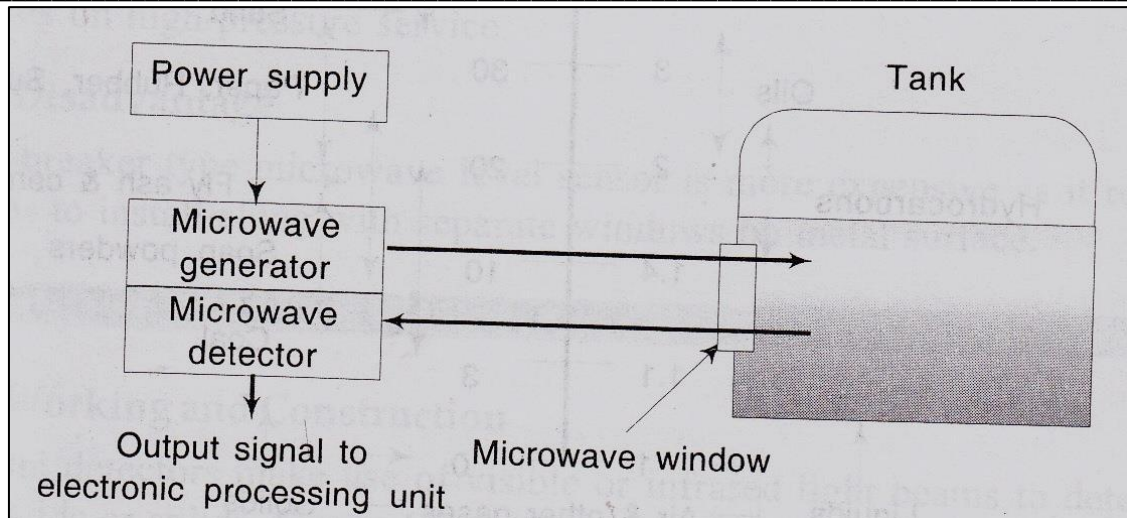


When this stage is reached the temperature may be read off from the galvano-meter provided that the Rheostat is not moved after the temperature match is obtained.

b) Describe the working principal RADAR type level measurement with neat diagram.

Ans: Diagram:

(Diagram-2M, Working Principal-2M)



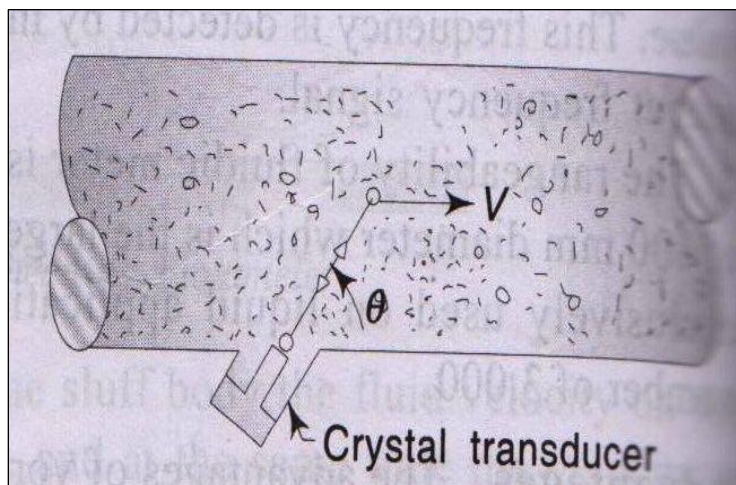
Working Principal:

In microwave reflection level the changes in the amplitude and or phase of the reflected signals used to determine material presence.

- Reflection is proportional to the dielectric constant of the material immediately next to process window.
- The microwave signal is generated by the micro wave generated and strikes the material surface in the tank through the microwave window.
- The reflected beam is received by the microwave detector and it compares the return to a reference signal in a balanced bridge circuit to provide additional sensitivity.

c) Explain the working principle of Doppler type ultrasonic flow meter. Give its two advantages and disadvantages.

Ans: (Diagram-1M, working principal-1M, advantages and disadvantages- 2 M)





Working Principal:

- In Doppler flow meter an ultrasonic wave is projected at an angle through the pipe wall into the liquid by a transmitting crystal in a transducer mounted outside the pipe.
- Part of the ultrasonic wave is reflected by bubbles or particles in the liquid and is returned through the pipe wall to a receiving crystal.
- Since the reflector (bubbles) are travelling at the fluid velocity the frequency of the reflected wave is shifted according to the Doppler principal.

The velocity of the fluid is given.

$$V = \frac{\Delta f c_t}{2 f_0 \cos \phi} = \Delta f k$$

Δf = difference between transmitted and received frequency

c_t = Velocity of sound in the transmission

ϕ = angle of transmitter and receiver crystal with respect to the pipe axis.

K = constant

f_0 = Frequency of transmitter

Advantages:

- It has no moving parts.
- Its velocity (Output relationship is linear)
- Excellent dynamic response.

Disadvantages:

- Complex circuit
- Relative high cost

d) Define:

- Absolute pressure**
- Gauge pressure**
- Atmospheric pressure**
- Vacuum pressure**

Ans:

(Each point -1M)

- Absolute pressure:** The absolute pressure is actual total pressure (including atmospheric pressure) acting on a surface. It is abbreviated as Psia (pound per square inch absolute)
- Gauge Pressure:** A gauge indicates zero at atmospheric pressure measure that difference between actual and atmospheric pressure.
- Atmospheric pressure:** The atmospheric pressure is the standard pressure or reference. The atmospheric pressure is approximately 14.696 Psi
- Vacuum Pressure :** Vacuum Pressure is also known as differential pressure. Vacuum Pressure is the difference between absolute pressure and atmospheric pressure.



e) Write two examples of:

- i) Analog transducer
- ii) Resistive transducer
- iii) Inductive transducer
- iv) Digital transducer

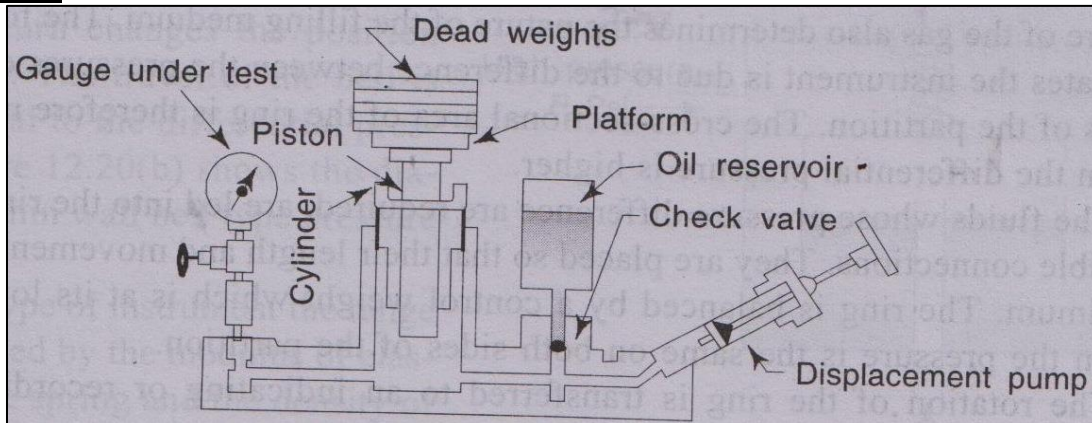
Ans: (Each point-1M, Any two suitable example to be consider)

- (i) **Analog transducer:** Example 1) LVDT, 2) Thermocouple
- (ii) **Resistive transducer:** Example 1) Linear Pot, 2) Angular Pot
- (iii) **Inductive transducer:** Example 1) LVDT, 2) RVDT
- (iv) **Digital transducer:** Example 1) ADC 2) Digital tachometer

f) Draw and explain the calibration procedure of elastic pressure gauges using dead weight tester.

Ans: (Diagram-3M, Procedure-1M)

Diagram:



Procedure:

- First a known weight is placed on the platform and the fluid (oil) pressure is applied on the other end of the piston until enough force is developed to lift the piston-weight combination and the piston floats freely within the cylinder between limit stop.
- In order to reduce the friction between the piston and the cylinder the piston is generally rotated while a reading is being taken.
- The error in a dead weight tester is less than 0.1%.



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SUMMER- 16 EXAMINATION

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Model Answer

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