WINTER– 18 EXAMINATION

Subject Name: Industrial Measurements   Model Answer   Subject Code 17434

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Important Instructions to examiners:

1) The answers should be examined by key words and not as word-to-word as given in themodel answer scheme.
2) The model answer and the answer written by candidate may vary but the examiner may tryto assess the understanding level of the candidate.
3) The language errors such as grammatical, spelling errors should not be given moreImportance (Not applicable for subject English and Communication Skills.
4) While assessing figures, examiner may give credit for principal components indicated in thefigure. The figures drawn by candidate and model answer may vary. The examiner may give credit for anyequivalent figure drawn.
5) Credits may be given step wise for numerical problems. In some cases, the assumed constantvalues 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.

Q. No.	Sub Q. N.	Answers	Marking Scheme
1	(A)	**Attempt any SIX :**	12- Total Marks
	(a)	**Define primary & secondary transducer.**	2M
	Ans:	i) **Primary Transducer**: The detector or sensing element which senses the physical phenomenon and converts it into a measurable quantity, whose output forms the input of another transducer is called a primary transducer. ii) **Secondary Transducer**: A transducer which converts analogous output of primary transducer into an electrical quantity is called a secondary transducer.	**1 mark for each definition**

(b)	List any two materials for Piezoelectric transducer.	2M
Ans:	i) Quartz crystal, ii) Barium titanete , iii) Rochelle salt , iv) Lithium Sulphate, v) Potassium Dihydrogen phosphate.	**Any 2** **Each for 1 Mark**
(c)	List different flow measurement methods	2M
Ans:		2M
(d)	State two applications of Ultrasonic level measurement.	2M

Ans:	i) It is used for measurement of hazardous fluid level. ii) It is used for measurement of liquid or solid material level of tanks used by dairies, chemical plants, mineral companies. **iii)** It is used for measurement of waste products in waste water treatment plants. V) It is used for measurement of sand, crushed rock, and gravel level in gravel open-cast mines.		**Any 2** **Each for** **1 mark**
e)	**What is Pt-100 ?**		**2M**
Ans:	The Resistance Temperature Detector (RTD) made of Platinum which has 100Ω resistance measured at 0^0C is called Pt-100.		**Correct meaning for 2 marks**
f)	**Give two applications of hair hygrometer.**		**2M**
Ans:	Hair hygrometers are used to measure relative humidity where high precision is not required. Some of the applications are, I) Process industries. iii) Coating industries. iv) Wooden musical instruments. v) Greenhouses. **vi)** A.C rooms		**Any 2** **Each for** **1 mark**
g)	**Define absolute pressure.**		**2M**
Ans:	Absolute Pressure is the actual total pressure including atmospheric pressure. $P_{absolute} = P_{actual} + P_{atmosphriec}$		**Correct definition for 2**

			marks
h)	**List different temperature scales.**		
Ans:	i) Fahrenheit (^0F) ii) Celsius (^0C) iii) Kelvin (^0K) iv) Rankine (^0R) v) Reaumur ($^0R'$)		½ mark each for any four
(B)	**Attempt any TWO :**		08- Total Marks
a)	**Convert 200^0F into Celsius(^0C) & Kelvin (^0K)**		4M
Ans:	i) $^0C=(5/9) * (^0F – 32)$ $= (5/9) * (200 - 32)$ $^0C = 93.33\ ^0C$ ii) $^0K = ^0C + 273.15$ $^0K = 93.33 + 273.15$ $^0K = 366.48\ ^0K$		each calculation 2 marks
b)	**Compare variable head flow meter with variable area flow meter.**		4M

Ans:	Parameter	Variable head flowmeter	Variable area flowmeter	1 mark for each parameter
	Working principle	Restriction or obstacle is placed in the path of flow to create a differential Pressure.	The pressure difference is kept constant by changing the restriction area.	

Basic Construction	The construction depends on the type of primary element used. Accordingly these are of the following types 1) Orifice plate 2) Venturi tube 3) flow nozzle	Tapered transparent glass tube with lesser diameter at the bottom fitted with a metal float inside, called rotameter.
Maintenance cost	minimum	minimum
Use	Used in viscous fluid slurries and dirty fluids.	In laboratories and testing and production lines.

	c)	**State the use of RADAR type level transducer & list two advantages.**	**4M**

	Ans:	**Applications of radar type transducer:**
		
		     i) RADAR type level transducer is suitable for large tanks with range upto 200m for level measurement.
		     ii) It is used for continuous level measurement.
		
		 Advantages of radar type transducer
		
		     i) High accuracy.
		     ii) Non-contact type.
		     iii) Not affected by corrosive materials.
			Any two applications-2M
			
			 Any two advantages-2M

Q. No.	Sub Q. N.	Answers	Marking Scheme
2		**Attempt any FOUR :**	16- Total Marks
	a)	**What is Psychrometer ? Explain dry bulb thermometer & wet bulb thermometer.**	4M
	Ans:	Psychrometers are instruments used for measuring relative humidity. **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	1 mark definition & 3M for explanation

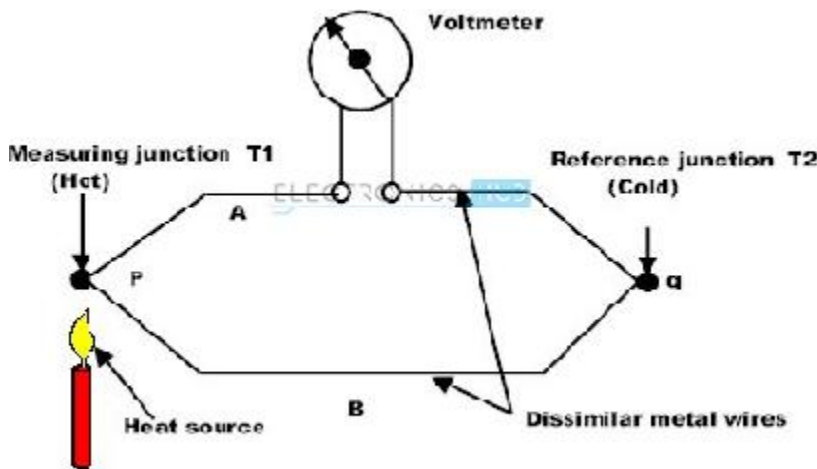|			
		freezing point of water, evaporation of water from the wick lowers the temperature, so that the wet-bulb thermometer usually shows a lower temperature than that of the dry-bulb thermometer. When the air temperature is below freezing, however, the wet-bulb is covered with a thin coating of ice 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.	
	b)	**State seeback effect. Describe the working of thermocouple.**	**4M**
		Seebeck effect: 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, an e.m.f is induced proportional to the temperature difference between the two junctions. thermocouple has two connected to form two junctions. One junction is kept at a constant temperature (cold junction) and the other in the medium whose temperature is to be measured (hot junction). When a temperature difference exist between both the junctions a very low emf is produced which causes a current in the circuit.	**2 mark** **2 mark**

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| c)	State the selection criteria for transducer (Any eight points).	4M
Ans:	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	**Any 8 pt** **½ for** **each**

d)	**Draw following and write application of each:**
	
	    (i) **Well type manometer**
	    (ii) **Bellows**
		4M

Ans:	i) **Well type manometer:**	**2M for** **each** **(1 mark** **for** **Diagram** **,1 mark** **for** **applicati** **on)**
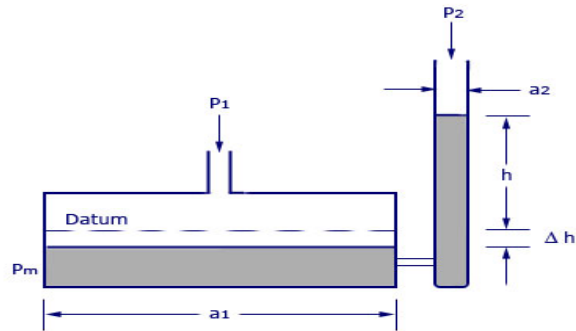
Well Type Manometer

Applications :

i)   It is used to measure very small pressure difference.

ii)   It is used in flow, pressure and force measurement systems.

Bellows:

Pressure measurement using Bellows
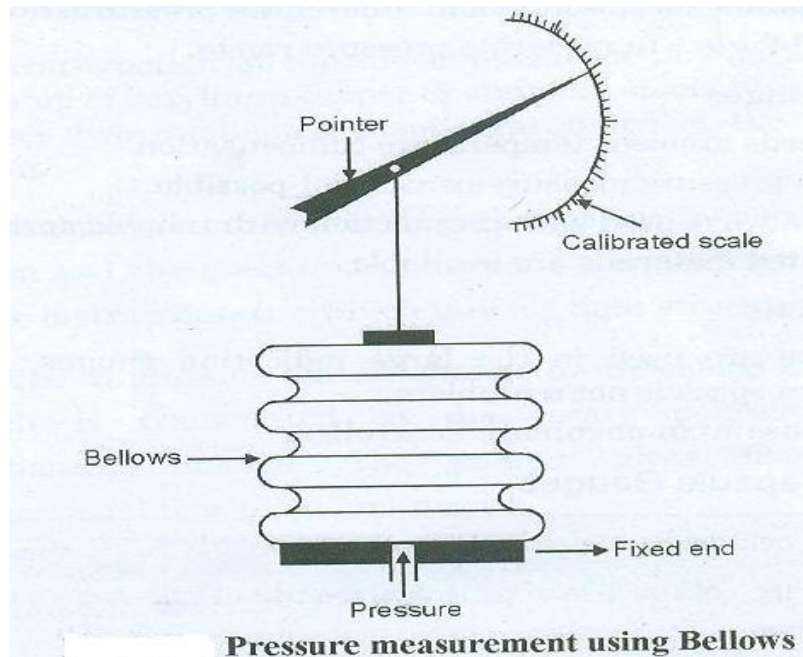
(1 mark for Diagram ,1 mark for application)

Applications:

i)   It is used in large indicating gauge, recorders where space is not a problem.

	ii) It is useful in pneumatic controller.	
e)	**State two advantages & two disadvantages of electromagnetic flow meter.**	**4M**
Ans:	**Advantage: (Any Two)** 1) Provides wide linear range. 2) Ability to measure reverses 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	**Any 2 pt** **2 mark**
	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.	**Any 2 pt** **2 mark**
f)	**Describe working principle of Ultrasonic level detector with diagram.**	**4M**
Ans:		**2 mark for diagram, 2 mark for explanat**
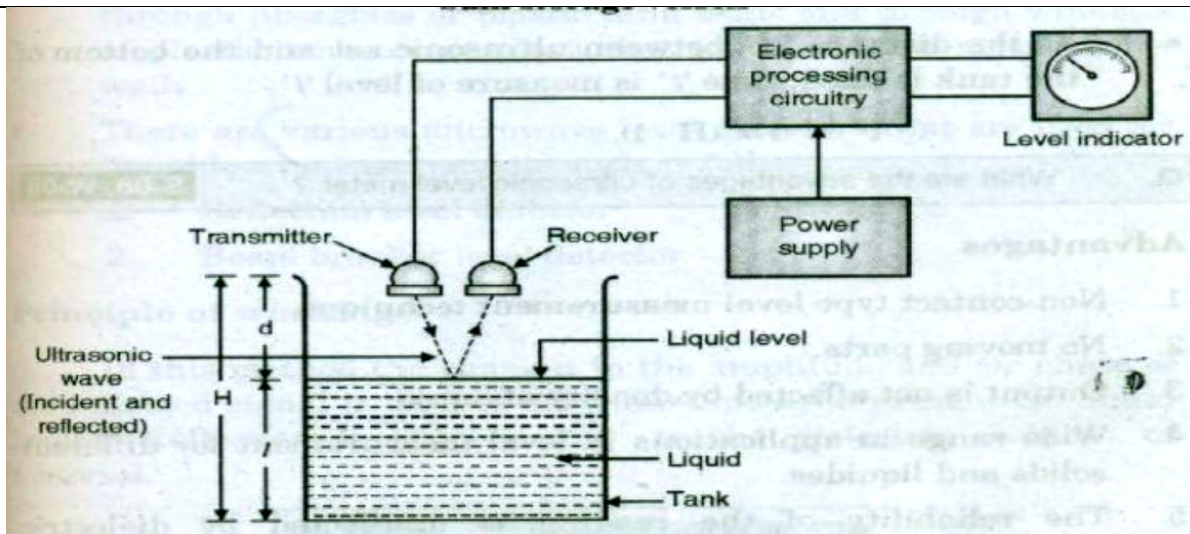
ion

Working Principle: ultrasonic level detector works on the principle of SONAR. It consists of a ultrasonic transmitter-receiver set mounted on the top of the tank. The beam is projected downward by the transmitter and is reflected back by the surface of the material inside the tank. The time 't' taken between the transmitting and receiving a pressure pulse is proportional to the distance between the ultrasonic set and the surface of the content inside the tank.

i.e, $t \propto d \propto H - l$,

where, l - level inside the tank.

H - height of tank

d - distance from the top of the tank upto the surface of content inside 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.	

Q. No.	Sub Q. N.	Answers	Marking Scheme
3		**Attempt any FOUR :**	**16- Total Marks**
	a)	**Write example of each type** (i) **Primary transducer** (ii) **Active transducer** (iii) **Electrical transducer** (iv) **Digital transducer**	**4M**
	Ans:	1) primary transducer –Bourdon tube ,Diaphragm, Bellows 2) Active transducer- Thermocouple, Piezoelectric 3) Electrical transducer- Strain gauge, Electromagnetic flow meter, RTD 4) Digital transducer- Rotary encoder , shaft encoder.	**Each Example** **1M**
	b)	**Draw constructional details of C-type Bourdon tube & explain its working.**	**4M**
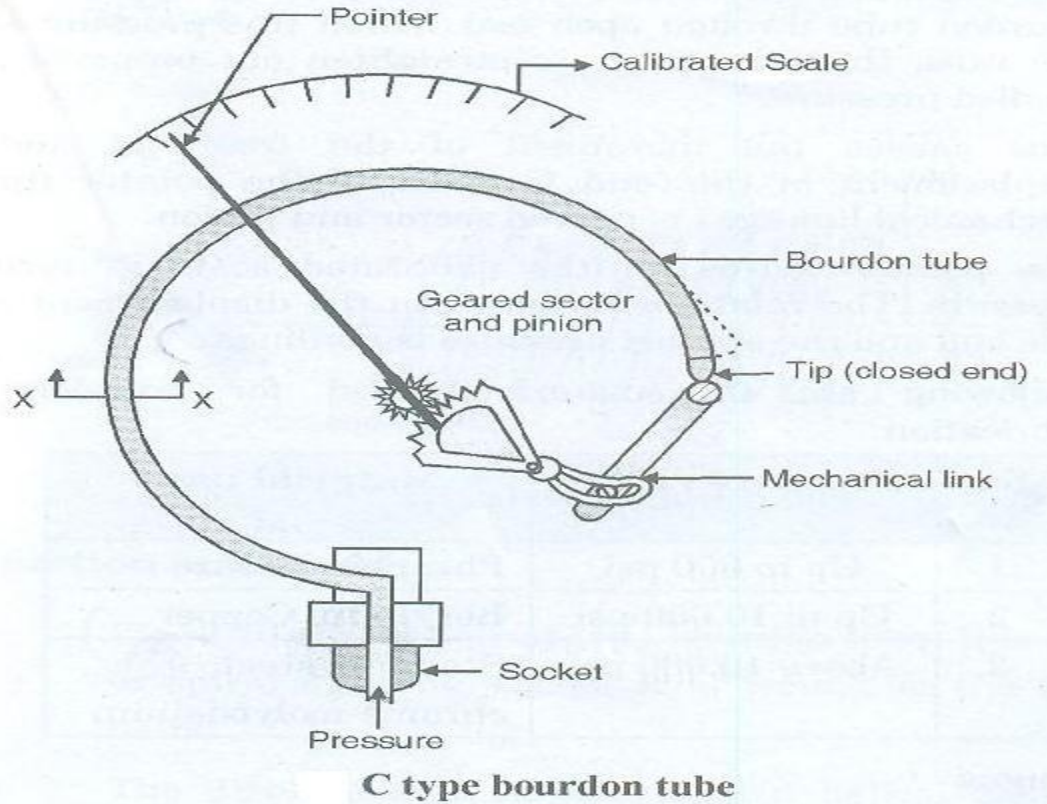
Ans:		**Construction -2M** **&** **Explain-2M**

C type bourdon tube

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 in nonlinear.	
c)	Compare contact type and non contact type methods of speed measurement.	4M
Ans:	<table><tr><th>Sr. No</th><th>Contact type speed measurement</th><th>Non-contact type speed measurement</th></tr><tr><td>1</td><td>Physical contact is present between meter and shift</td><td>No physical contact between meter and rotating shaft.</td></tr><tr><td>2</td><td>As output is electrical signal to indicate reading.</td><td>As the output are digital pulses,no need of A/D converter.</td></tr><tr><td>3</td><td>Due to contact with rotating parts maintenance is high</td><td>As there is no contact structure maintenance free</td></tr><tr><td>4</td><td>e.g. A.C Tachometer, D.C. Tachometer</td><td>e.g. Magnetic picup meter,</td></tr></table>	Each point 1M
d)	Calculate output resistance of PT- 100 RTD for temperature value 40^0 C & 80^0 C.	4M

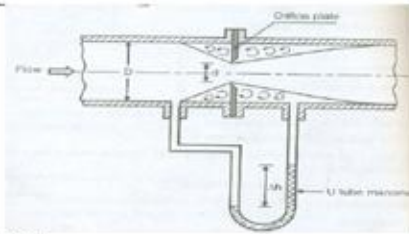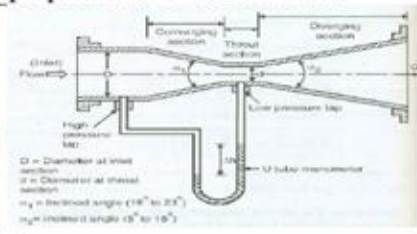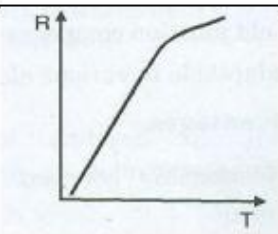|			
	Ans:	For PT = 100, $R_0 = 100\Omega$, $t = 0°C$ Let $\alpha = 0.00392/°C$ Relation between resistance & temperature for resistance thermometer is $R_t = R_0(1 + \alpha_0 \Delta t)$ i) Resistance at 40°C $R_t = 100(1 + 0.00392 \times 40)$ $\boxed{R_t = 115.68\ \Omega}$ ii) Resistance at 80°C $R_t = 100(1 + 0.00392 \times 80)$ $\boxed{R_t = 131.36\ \Omega}$	Each calculation- 2M
e)		Compare orifice with venturi tube with reference to (i) Working principle (ii) Construction (iii) Cost (iv) Pressure loss	4M
	Ans:		Each point 1M

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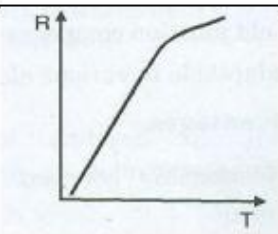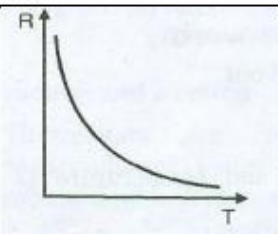Subject Name: Industrial Measurements   _Model Answer_   Subject Code 17434

Sr.No	Parameter	Orifice plate	Venturi tube
1	Working principle	It is variable area flow meter in which the differential pressure is developed by using orifice plate by inserting it in the path of the fluid flow.	Ventury tube operates on the principle that when restriction is placed in the path of flow, it produces differential pressure across the restriction which is proportional to the flow rate.
2	Construction		
3	Pressure loss	High	Less
4	Cost	Low	High

f)	Compare between PTC & NTC.	4M

Ans:		Each point: 1M

Sr.No	PTC	NTC
1	It is positive temperature coefficient	It is negative temperature coefficient
2	As temperature increases resistance also increases $R \alpha\, T$	As temperature increases resistance also decreases $R \alpha\, 1/T$
3	PTC manufactured from barium titanate, titanium oxide, and powdered barium carbonate.	NTC composed of metal oxides such as manganese, nickel, cobalt, copper, iron and uranium.
4		

Q. No.	Sub Q. N.	Answers	Marking Scheme
4		**Attempt any FOUR :**	16- Total Marks

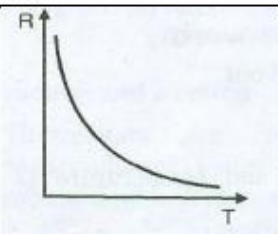**WINTER– 18 EXAMINATION**

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(a)	What is pyrometer? Explain any one type of pyrometer.	4M
Ans:	**Pyrometers:** Pyrometers is an instrument used for measuring temperature without any physical contact. It depends upon the relationship between the temperature of a hot body and the electromagnetic radiation emitted by the body. When a body is heated, it emits thermal energy known as heat radiation. A black matt surface (or a black body) is a very goodabsorber of heat radiation and, also, a very good emitter of such radiations whenheated. Pyrometry is a technique for determining a body's temperature by measuringits electromagnetic radiation. Types: **1. Optical pyrometers** **2 . Radiation Pyrometers** **Optical pyrometers** The working principle of optical pyrometer state that the brightness of light of a given color emitted by a hot source, gives an indication of temperature.	**Definition-1M** **Diagram-2M** **&** **Explanation-1M**

During the operation of optical pyrometer following conditions occurs.

1. When the temperature of the filament is higher than that required for equal brightness then the filament is too bright as shown in the figure.

2. When the temperature of filament is lower, the filament becomes too dark as shown in fig.

3. When the brightness of image produced by the source and brightness produced by the filament are equal, the outline of the filament disappears as shown in fig.

(OR)

Radiation Pyrometers: Construction of radiation pyrometers, which consist of blackened tube. One end is exposed to the hot body whose temperature is to be measured, at the other end of the tube sighting aperture is present, is which an adjustable eye piece is fitted.

i)   One concave mirror is provided as shown in figure to collect the radiations coming from the body whose temperature is to be measured.

ii)   The position of concave mirror is adjusted using rack and pinion so as to get proper focusing of thermal radiation on the detector disc. The detector disc consists of blackened platinum sheet or foil.

iii)   The output of detector is given to the meter for measuring the thermoelectric EMF or resistance which is a direct indication of temperature of hot body.
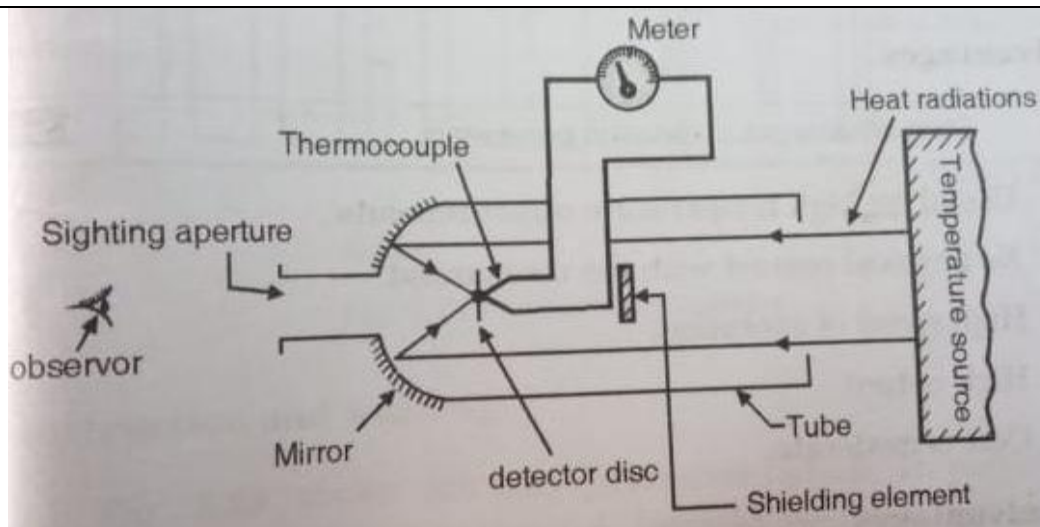
Radiation Pyrometer

(b)	State working principle of capacitive type level measurement with diagram.	**4M**
Ans:	The capacitive level detector operates on the equation of parallel plate capacitor, i.e. $C = \varepsilon A/d$ Where, C = capacitance value in farad ε = dielectric constant d = distance between two plate in m A = common area of plate in m2. If A and d are constant then capacitance is directly proportional to dielectric constant i.e. C α dielectric constant (ε). This principle is used in the capacitance level gauge for detecting level change.	**Working principle -2M** **&** **Diagram -2M**

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Capacitance Level gauge
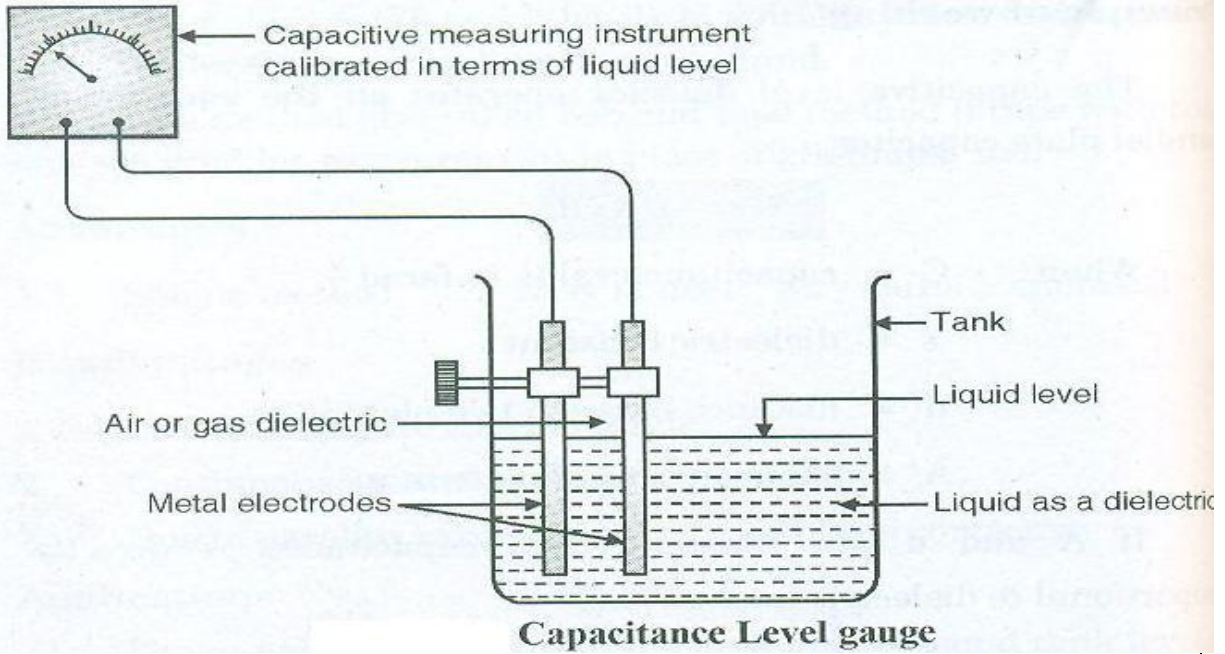
(c)	Describe the working principle of photoelectric pickup type tacho-generator.	4M
Ans:		Working principle -2M & Diagram -2M
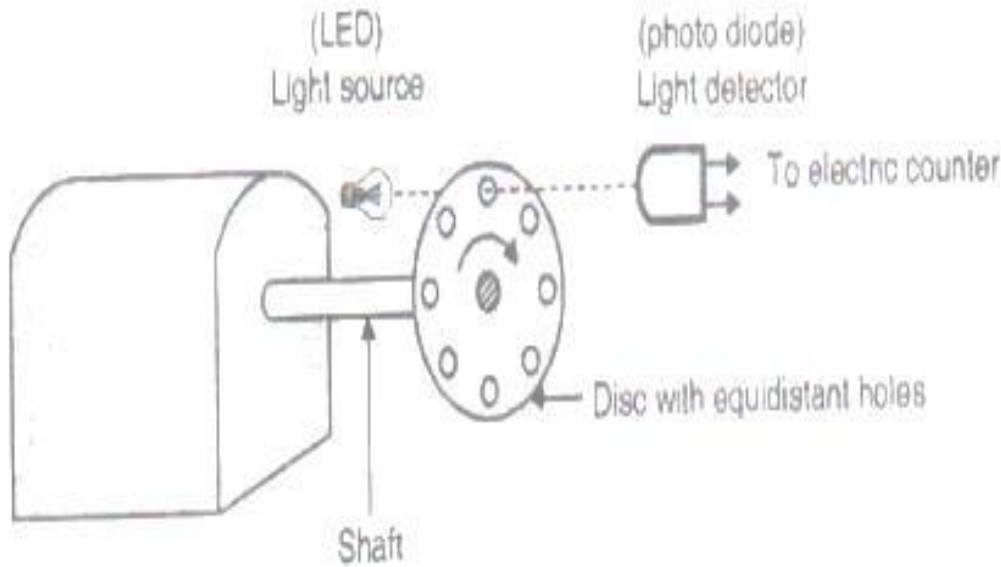
Working:

- 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 a 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, alight sensor like phototube or some photosensitive semiconducting device is placed.	
		• When a hole appears between the 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	
(d)		**State how pressure measurement can be done using Dead weight tester.**	**4M**
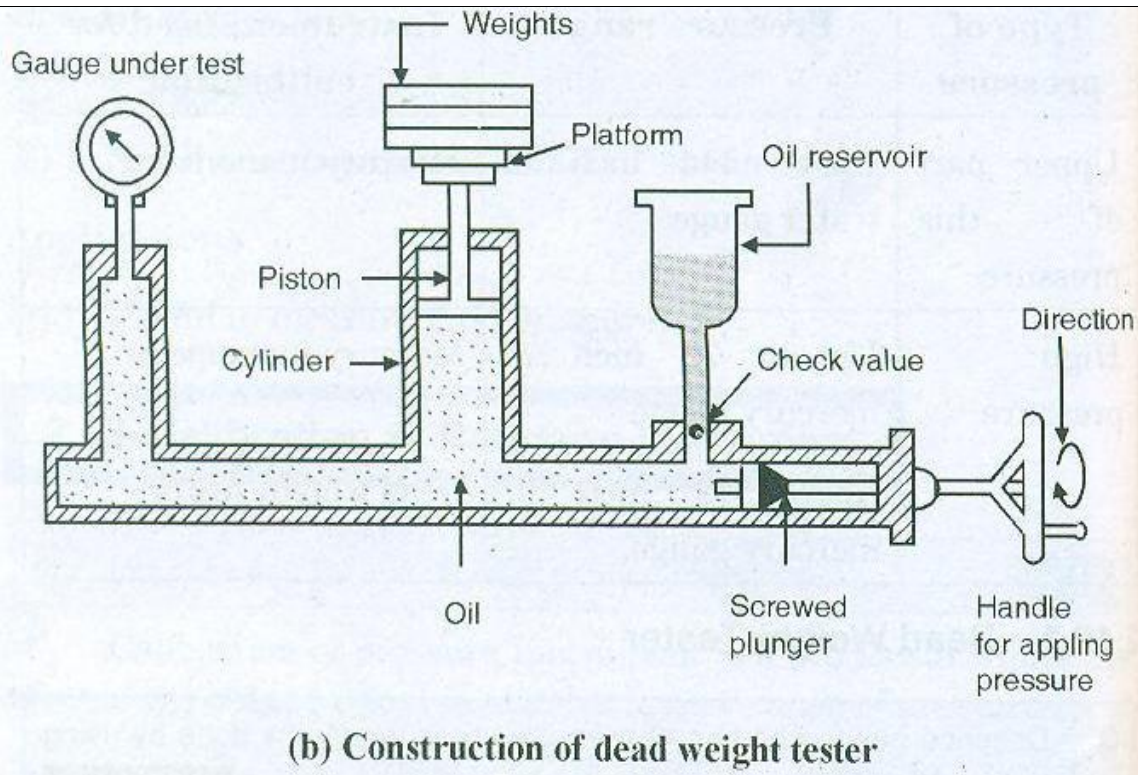
Ans:	(b) Construction of dead weight tester	**Diagram -2M** **&** **Method- 2M**
	The handle is fully drawn out and the oil is allowed to enter in the cylinder (i.e. gauge and piston) The weight to be measured is placed on the platform. Now the handle is turned in clockwise direction so that pressures will buildup on the gauge side as well as at platform side. Increase the pressure by rotating the handle clockwise until enough pressure is developed inside the cylinder and lifts the platform with weights placed on it and it floats freely within the limit stops. The product of the area of the piston and the pressure indicated on the gauge is equal to the weight under measurement.	
(e)	**Sketch diagram for pressure measurement using diaphragm with strain gauge.**	**4M**
Ans:	**Diagram:**	**Labeled diagram -4M**

Pressure Measurement With Strain Gauges on Diaphragm
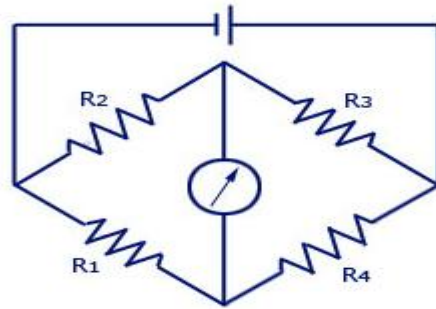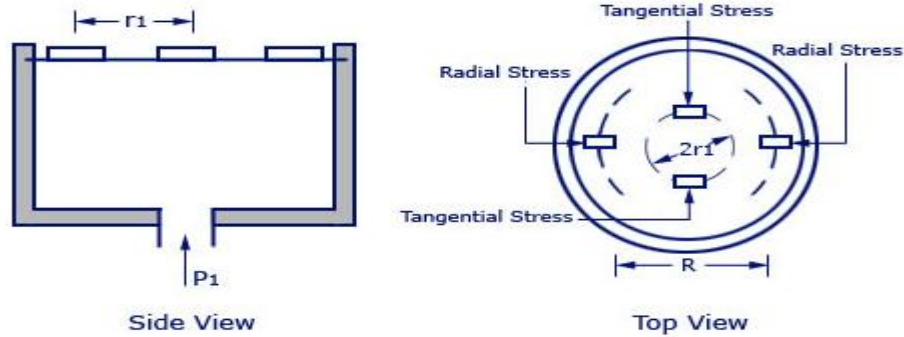
f)	**State principle of operation of piezo-electric transducer. State its application.**	**4M**
Ans:	The piezoelectric element used for converting mechanical movement into electric signals. The mechanical deformation generates charges and this charge appears as a voltage across the electrodes. The voltage is given by $V = Q/C$ where, V = e.m.f. across electrode Q = charges C = capacitance **Operating principle:** When force or pressure is applied to the piezoelectric material like quartz crystal or barium titanate, then an emf is generated across the material or vice versa.	**Operation-2M** **&** **Application-2M**
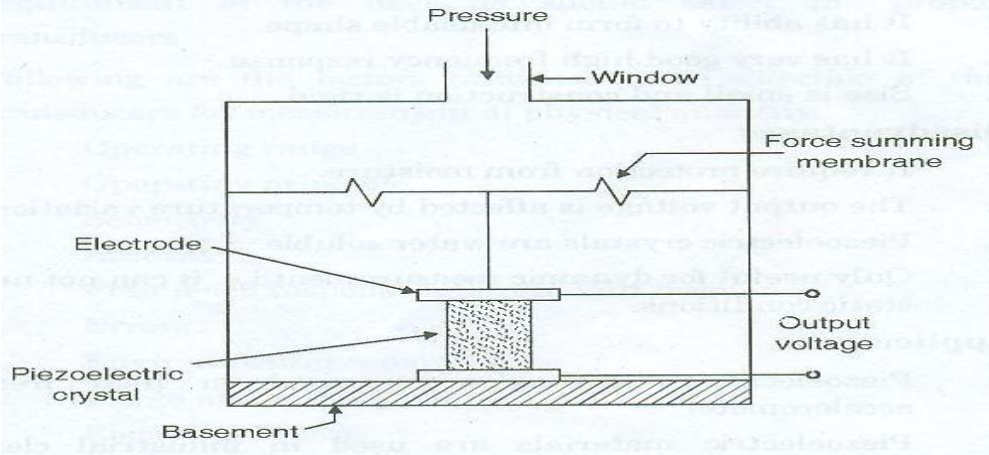
Pressure measurement using piezoelectric transducer

Applications (any two)

1. Piezoelectric transducers are used in high frequency accelerometer.

2. Piezoelectric materials are used in industrial cleansing apparatus.

3. It is used in under water detection system i.e. SONAR.

4. These are used in measurement of surface roughness in accelerometers and vibration picks ups.

5. It is used in ultrasonic flow meters, non-destructive test (NDT) equipments

6. Piezoelectric materials are used in ultrasonic transducers.

Q. No.	Sub Q. N.	Answers	Marking Scheme
5.		**Attempt any FOUR :**	16- Total Marks
	a)	**Write the materials used for 'type J' & type K' thermocouple along with their temperature range and its sensitivity.**	4M

Ans:	**Type**	**Tempreture Range**	**Material Used**	**Sensitivity µV/0C**	**2m for each type**
	J	-200 to 900	Iron/Constantan	45-57	
	K	-200 to 1250	Chromel/Alumel	40-55	

b)	**State need of level measurement. Also, classify level measurement methods.**	**4M**
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.	**Need 2M**

Classification of Liquid Level Measurement

Direct Method

1. Hook type

2. Sight glass type

3. Float type

4. Dip stick

Indirect method

1. Hydrostatic pressure type

2. Electrical type:

a) Capacitance level indicator

		b) Radiation level detector c) Ultrasonic level gauge 3. RADAR type	
	c)	**Define Laminar flow & turbulent flow. Also, write two units for flow measurement.**	**4M**
	Ans:	**Laminar Flow:** When all the molecules of flow are parallel to each other, it is called laminar flow. **Turbulent flow:** When the flow molecules are scattered without any fixed pattern, it is called Turbulent Flow. SI unit is m^3/s (cubic metres per second). Reynolds number	**2M each**
	d)	**Describe working principle of U-tube manometer with neat diagram.**	**4M**
	Ans:	Diagram:	**2M**

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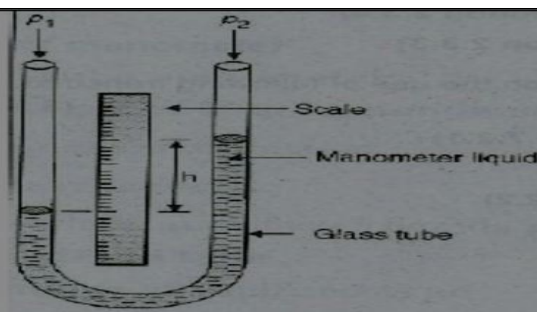
Fig: U- Tube manometer
P_1 = High pressure
P_2= Low pressure
h= Difference in level liquid.

Explanation: (2 M)

This manometer consists of a U shaped tube in which the manometeric liquid is filled. The manometer is used to measure the pressure which is unknown by the balancing gravity force and acceleration due to gravity, g = 9.81 m/sec2

The unknown pressure is applied in the one arm of the tube and the mercury in the tube or manometeric liquid filled in the tube moves in the tube or rises to the constant region and then the movement is stopped. The height of the liquid is measured and noted. The pressure is calculated by using the formula, The fundamental relationship for pressure expressed by a liquid column is P1-P2=(ꝑ- ꝑ1)(h1-h2)g

- Thus P=(ꝑ- ꝑ1)hg

- Where, ꝑ is density of fluid in u tube, ꝑ1is density of fluid whose pressure is to be measured , h=difference in liquid level , g acceleration due to gravity

	e)	**Draw block diagram of instrumentation system. State function of each block.**	**4M**
	Ans:		**2M**

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Explanation-

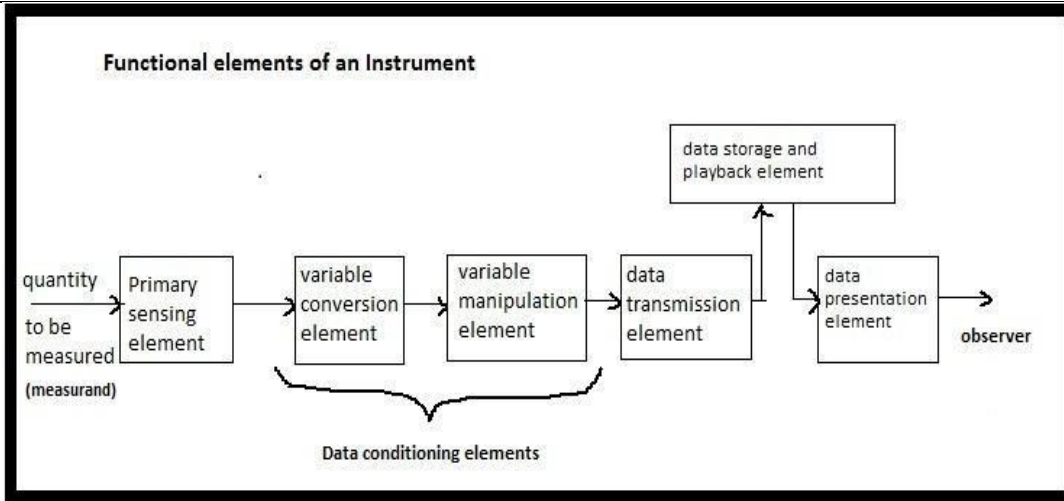**Functions of each block:**

1) Primary sensing element: This first receives energy from the measured medium and produces an output depending on measured quantity.

2) Variable conversion element: Converts the output signal of the primary sensing element into a more suitable variable or condition useful to the function of the instrument.

3) Variable manipulation element: Manipulates the signal represented by some physical variable, to perform the intended task of an instrument. In the manipulation process, the physical nature of the variable is preserved.

4) A data transmission unit: Transmits the data from one element to the other.

5) A data presentation element: Performs the translation function, such as the simple indication of a pointer moving a scale or the recording of a pen moving over chart.

2M

f)	**Compare AC & DC tachogenerators.**	4M

Ans:	Any four points		1 M each
	AC tacho generators.	**DC tacho generators.**	
	The AC tachogenerator is use to measure speed only in one direction only.	The DC tachogenerator is use to measure speed in both direction.	
	It consists of a stator and a rotor arrangement or a squirrel cage setup	It consists of horse shoe type permanent magnet.	
	Need of rectifier to convert AC output into DC.	Output is in DC form therefore no need of rectifier.	
	No problem of brush friction and brush bounce.	Problem of wear and tear brushes at high speed.	
	Ripples are reduced.	Small ripples are appearing at output.	
	Maintenance is difficult.	Easy to maintenance.	

Q. No.	Sub Q. N.	Answers	Marking Scheme
6.		**Attempt any FOUR :**	**16- Total Marks**
	a)	**Draw constructional diagram of LVDT. State its working principle.**	**4M**
	Ans:	**Diagram:**	**2M**

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WINTER– 18 EXAMINATION
Subject Name: Industrial Measurements   <u>Model Answer</u>   Subject Code: 17434

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Construction and Circuit Connection of LVDT
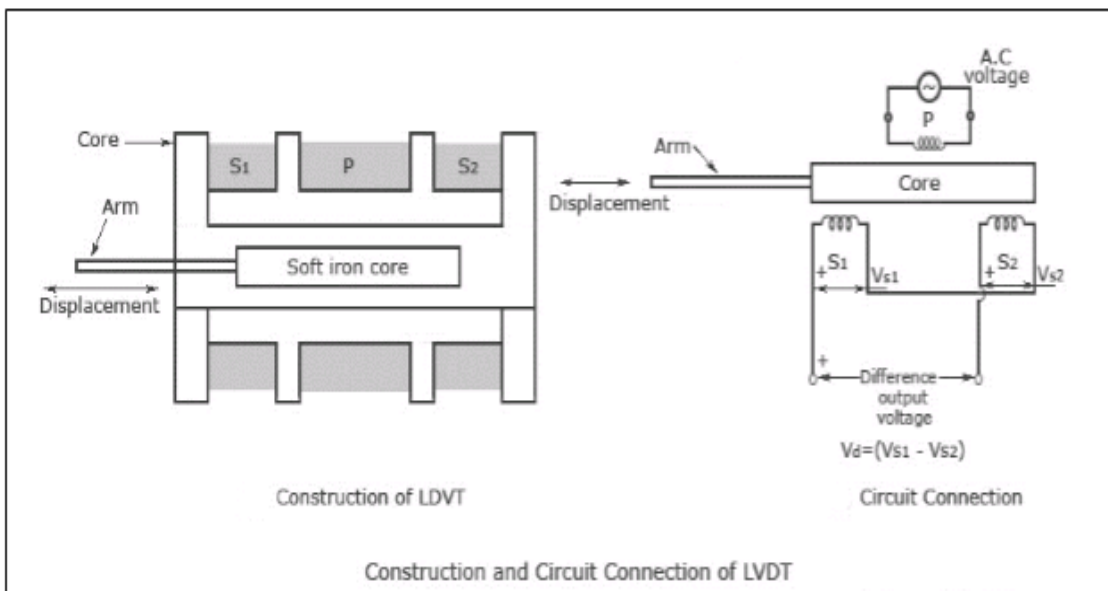
| | 2 M |

Explanation:

A differential transformer consist of one primary winding & two secondary winding.

The windings are arranged concentrically and next to each other. When the core is at center, two unequal voltage are induced in the secondary windings. To obtain single voltage at o/p these two winding are connected in series opposition. Hence o/p will be difference of these two voltage

Therefore $V_0 = V_1 - V_2$.

Hence it is called a differential transformer.

When core is in neutral or zero position, voltages induced in secondary windings are equal and opposite producing a net zero output.

When core is moved right from zero position then output is in phase with the supply voltage and is positive

when core is moved towards left from zero position, then output is 180 degree out of phase and is taken as negative.

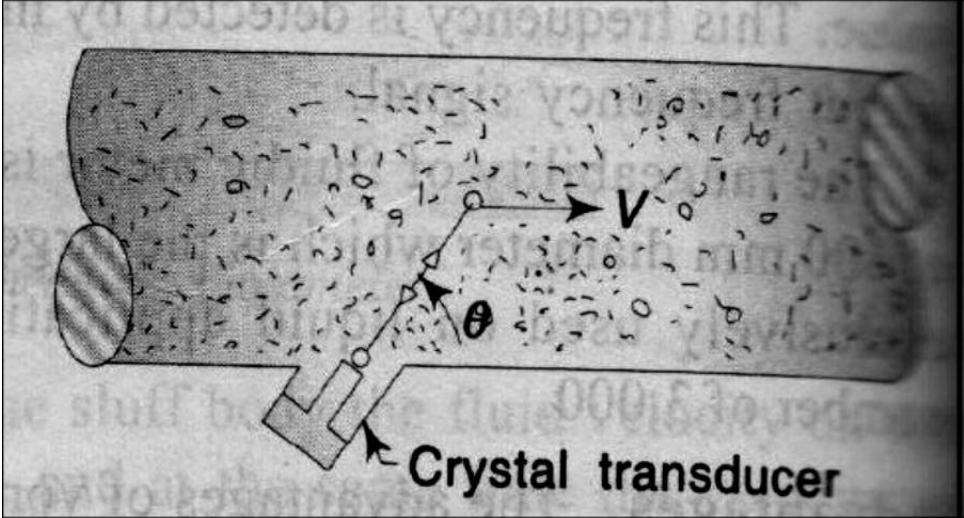| b)	Compare capsule & Bellows with the help of (i) Material used (ii) Construction (iii) Range of measurement (iv) Working principle			4M

Ans:	Sr.No.	Parameters	Capsule	Bellows	1M each
	1	Construction	The capsule consists of two diaphragms joined and sealed around their circumference.	It consist of elastic element that is convoluted and expand and contracts axially with Change in pressure	
	2	Range of measurement	1 atmosphere – 0.5m bar	bellows can be used to measure pressures of over 1000 psig	
	3	Construction	The capsule consists of two diaphragms joined and sealed around their circumference.	It consist of elastic element that is convoluted and expand and contracts axially with Change in pressure	
	4	Working principle	The sensing element of a capsule pressure gauge consists of two corrugated diaphragms welded together at their periphery to form a capsule.When the pressure rises inside the capsule, both diaphragms will slightly	Bellows are thin-walled metallic cylinders, with deep convolutions, of which one end is sealed and the other end remains open. ... When pressure is applied to the closed end,they will either expand or contract.	

			deform	
c)	Explain the working principle of Doppler type Ultrasonic flow meter.			4M
Ans:	**Diagram:**			2 M
	Working Principle: (2 M) • 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 principle.			
d)	How level is measured by using float? State material used for float.			4M

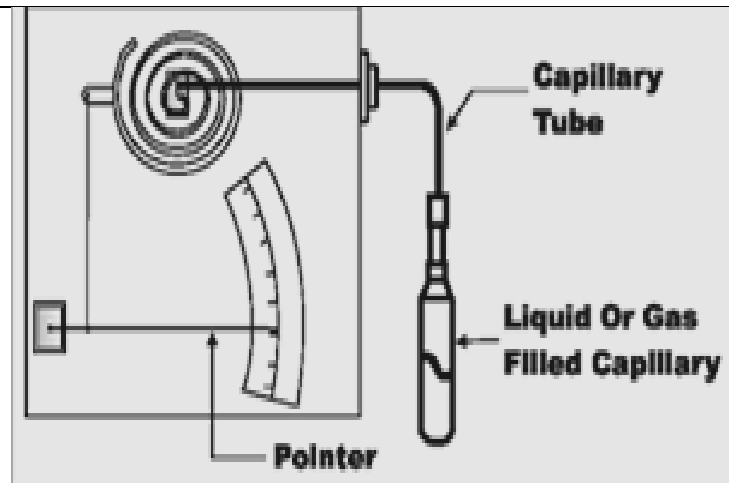|			
	Ans:	**Diagram**	**2 M**
		or	
		Explanation (2 M)	
		Above figure shows the simplest form of float operated mechanism for the continuous liquid level measurement. In this case, the movement of the float is transmitted to the	
		pointer by stainless steel or phosphor-bronze flexible cable wound around a pulley, and the pointer indicates liquid level in the tank. The float is made of corrosion resisting material (such as stainless steel) and rests on liquid level surface between two grids to avoid error due to turbulence. With this type of instrument, liquid level from ½ ft. (152mm) to 60 ft. (1.52m) can be easily measured	
	e)	**Explain with suitable diagram, how gas filled thermometer works.**	**4M**
	Ans:	**Diagram**	**2 M**

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

In other words

Working of Gas thermometer is depend upon ideal gas law which state that the volume of

the gas increases with increase in temperature if pressure maintained constant.

Name of the gases used in Gas filled thermometers.

1. Nitrogen

2. Helium

3. Inert Gas

2M

f)	**Define absolute & relative humidity.**	**4M**
Ans:	**Absolute humidity** : It is defined as amount of vapour present in each unit volume of air or gas. **Relative Humidity**: It is the ratio of the moisture content of gas to the maximum moisture content in the gas at that temperature. **(OR)** **(i) Absolute humidity**: It is defined as a mass of water vapour present per unit volume. Absolute humidity changes as air pressure changes Unit of absolute humidity is Kg/m3 or g/m3. **(ii)Relative humidity:** It is defined as a ratio of moisture content of gas to the maximum moisture the gas can contain at that temperature.	**2 M each**