



SUMMER– 18 EXAMINATION

Subject Name: Industrial Measurements Model Answer

Subject Code: 17434

Important Instructions to examiners:

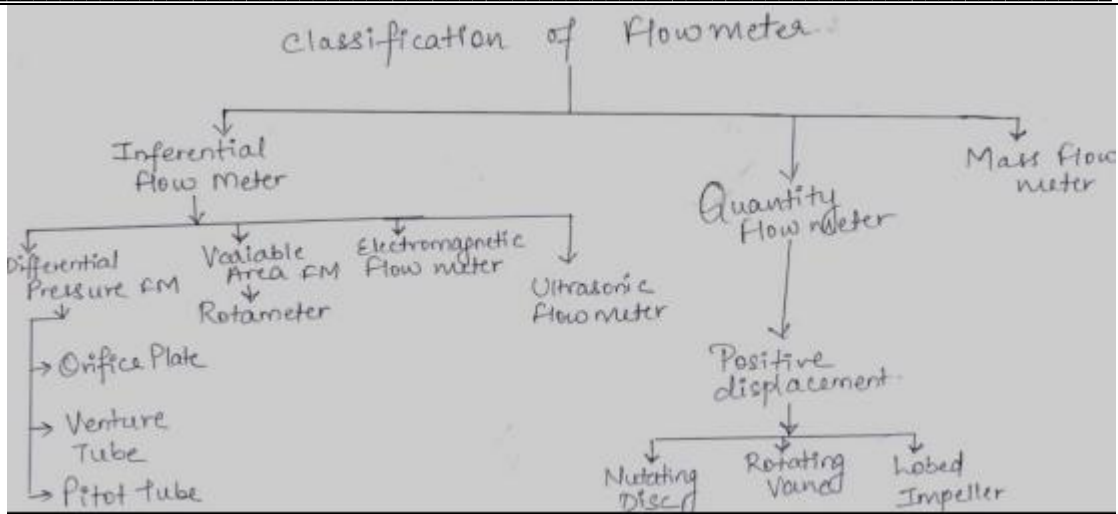
- 1) The answers should be examined by key words and not as word-to-word as given in the model answer scheme.
- 2) The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate.
- 3) The language errors such as grammatical, spelling 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.

Q. No.	Sub Q. N.	Answers	Marking Scheme
1	A	Attempt any SIX:	12- Total Marks
	a	Define transducer. Give two examples.	2M
	Ans:	Definition: Transducer is defined as a device which converts energy from one form to another i.e. physical to physical, physical to electrical or electrical to physical. Example: 1) Thermocouple 2) RTD 3) Thermistor 4) Bimetallic strips 5) Bourdon Tube 6) Rotameter 7) Ventury tube 8) Orifice plate	Definition 01 M Any 02 Example ½ M each
	b	State classification of flow meters.	2M
	Ans:		2 Marks

SUMMER- 18 EXAMINATION

Subject Name: Industrial Measurements Model Answer

Subject Code: 17434



c Define laminar flow and turbulent flow.

2M

Ans:

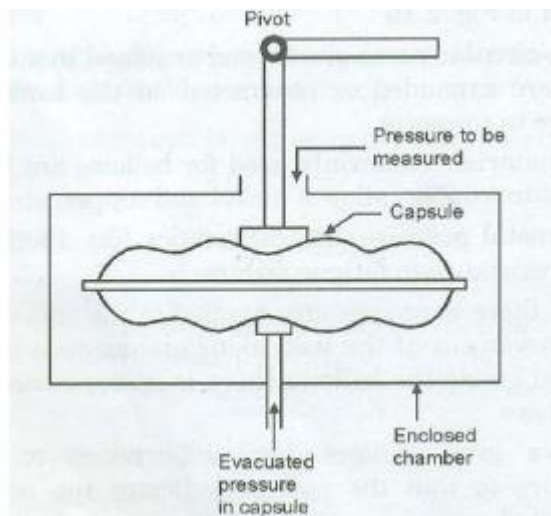
- **Laminar Flow:** When all the molecules of flow are parallel to each other, it is called laminar flow.
- **Turbulent flow:** When the flow molecules are scattered without any fixed pattern, it is called Turbulent Flow.

01 M each

d Draw only diagram of capsule.

2M

Ans:



(OR)

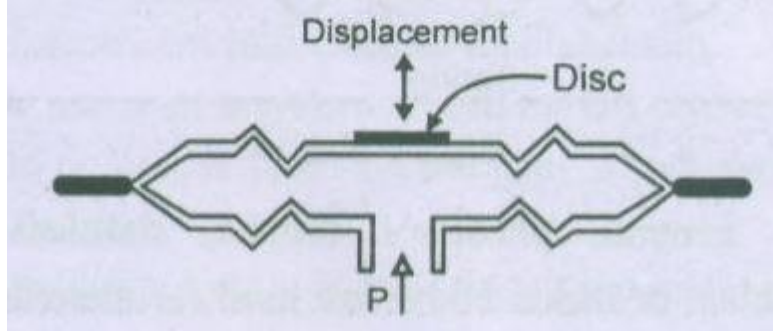
02 Marks



SUMMER- 18 EXAMINATION

Subject Name: Industrial Measurements Model Answer

Subject Code: 17434



e List four electric pressure transducer.

2M

Ans: List of electric pressure measuring devices:

1 M each for any 04

1. Diaphragm with strain gauge
2. Bourdon Tube with LVDT
3. Differential Pressure cell
4. Piezoelectric type pressure transducer
5. Capacitance pressure transducer
6. Optical Pressure transducer
7. Resistive pressure transducer

f State the necessity of transducer.

2M

Ans: Necessity of Transducer:

02 M

Input quantity for most of the Instrumentation systems is non – electrical quantity. To convert non- electrical quantities like heat, pressure, level, flow rate, humidity, temperature, etc. into electrical quantity in order to use electrical methods and techniques for measurement, manipulation and control, transducers are required.

g Define (i) Absolute Humidity (ii) Relative Humidity.

2M

Ans: i) **Absolute Humidity:** It is defined as the mass of water vapour present per unit volume.

$$H_A = m/Vg, \text{ Its unit is gram per cubic meter (g/m}^3\text{)}$$

ii) **Relative Humidity:** It is defined as a ratio of moisture content of the gas to the maximum moisture the gas can contain at that temperature.

$$\% H_R = \rho_g \times 100 \rho_s$$

Where,

ρ_g = moisture content of gas

ρ_s = fully saturated air

OR

Relative Humidity is defined as a ratio of the amount of water vapour actually present to the maximum amount of water vapour the gas can contain at that

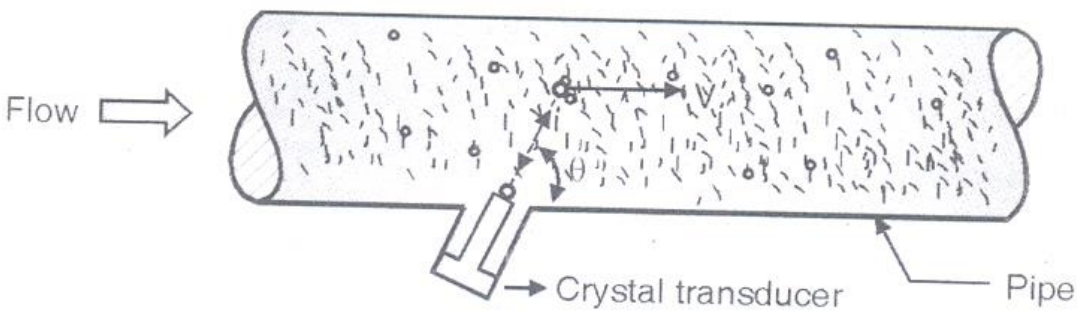
01 Mark each



SUMMER- 18 EXAMINATION

Subject Name: Industrial Measurements Model Answer

Subject Code: 17434

	temperature.	
h	List the four different units of pressure.	2M
Ans:	The different units of pressure : <ol style="list-style-type: none"> 1) N/M² (Newtons Per meter Square) 2) Pascal (Pa) 3) Bar 4) Torr 5) mm Hg (Millimeter of Mercury column) 6) mmWC (Millimeter of Water Column) 7) PSI (Pounds per Square inch) 8) Psia (Pounds Per Square inch absolute) 9) Psig (Pound Per Square inch gauge) 	Any four ½ marks each
B	Attempt any TWO:	8- Total Marks
a	What is piezoelectric effect? Name two piezoelectric material.	4M
Ans:	piezoelectric effect: Piezoelectric effect can be stated as follows: “ when a pressure or force or vibration is applied to crystalline material like quartz crystal or crystalline substances, then an e.m.f. is generated across the material or vice versa”. Piezoelectric Materials: <ol style="list-style-type: none"> 1) Natural crystal: Quartz crystal ,Rochelle salt 2) Synthetic crystals : Barium Titanate, Lithium sulphate 	02 M 02 M for any two piezoelectric material
b	Describe principle of operation of Doppler type ultrasonic flow meter with diagram.	4M
Ans:	Diagram:  Working: <ul style="list-style-type: none"> • The flow meter consists of a crystal transducer mounted outside the pipe in which flow is to be measured. This transducer is a piezoelectric crystal which emits an ultrasonic wave and the wave is projected at an angle through the pipe wall into the liquid. • As the liquid flows through the pipe the particles and bubbles in the liquid also move and 	02 M



SUMMER- 18 EXAMINATION

Subject Name: Industrial Measurements Model Answer

Subject Code: 17434

	<p>these particles act as reflectors for the ultrasonic wave.</p> <ul style="list-style-type: none"> Part of the ultrasonic wave is reflected by the particles and bubbles in the liquid and is returned through the pipe wall to the transducer. The particles and bubbles move with the velocity of the fluid, so the frequency of the reflected wave is shifted to particle velocity, according to Doppler principle. 	02 M
c	Draw the constructional detail of C type bourdon tube and explain its working.	4M
Ans:	<p>Constructional Diagram:</p> <p>Working:</p> <ul style="list-style-type: none"> 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 fig. The free end of this tube is closed or sealed and the other end (fixed end) is opened for the pressure to enter. The free end is connected to the pointer with the help of geared sector and pinion. Calibrated scale and pointer is provided to indicate the pressure. 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. 	02 M

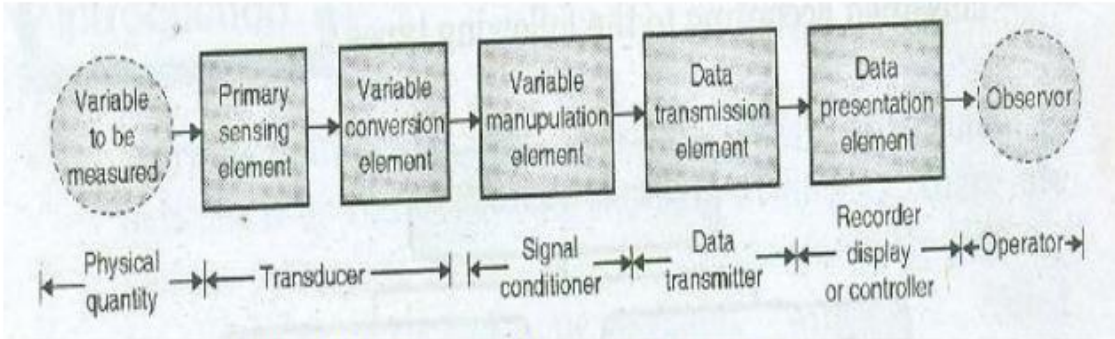
Q. No	Sub Q.	Answers	Marking
-------	--------	---------	---------



SUMMER- 18 EXAMINATION

Subject Name: Industrial Measurements Model Answer

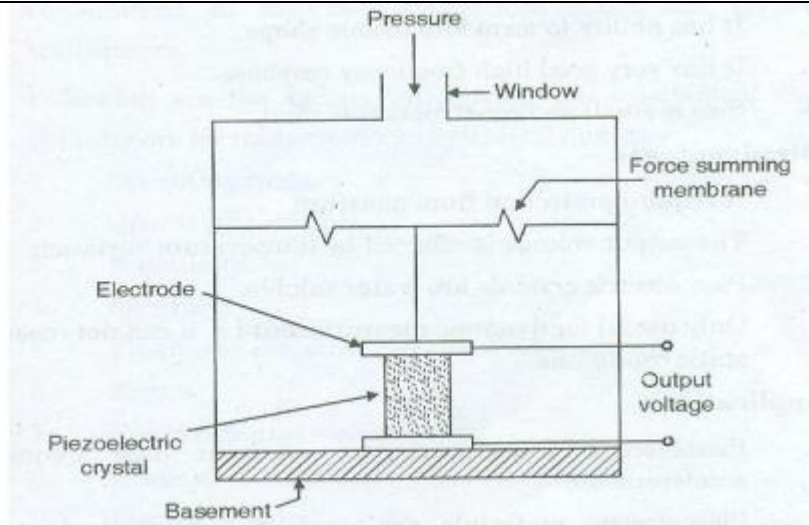
Subject Code: 17434

.	N.		Scheme
2		Attempt any FOUR:	16- Total Marks
	a	Draw block diagram of instrumentation system. State function.	4M
	Ans :	<p>Diagram:</p>  <p>Fig: Block diagram of instrumentation system.</p> <p>Functions of each block:</p> <ul style="list-style-type: none"> • Primary sensing element: This first receives energy from the measured medium and produces an output depending on measured quantity. • 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. • 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. • A data transmission unit: Transmits the data from one element to the other. • 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. <p>NOTE: marks may be awarded to any other relevant block diagram of instrumentation system.</p>	<p>2 marks for block diagram</p> <p>2 marks for functions</p>
	b	Draw the experimental setup to measure pressure in terms of voltage. Also discuss which types of transducer used in it.	4M
	Ans :	Diagram:	03 M

SUMMER- 18 EXAMINATION

Subject Name: Industrial Measurements Model Answer

Subject Code: **17434**



Types of Transducer used:

- 1) Natural crystals: Quartz crystal
- 2) Synthetic crystals : Barium Titanate

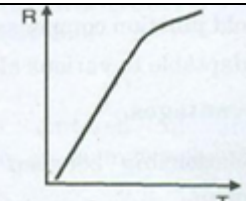
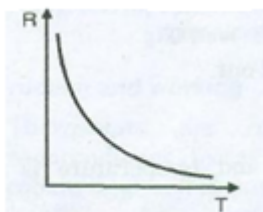
01 mark (any 1)

c State comparison between PTC and NTC.

4M

Ans:

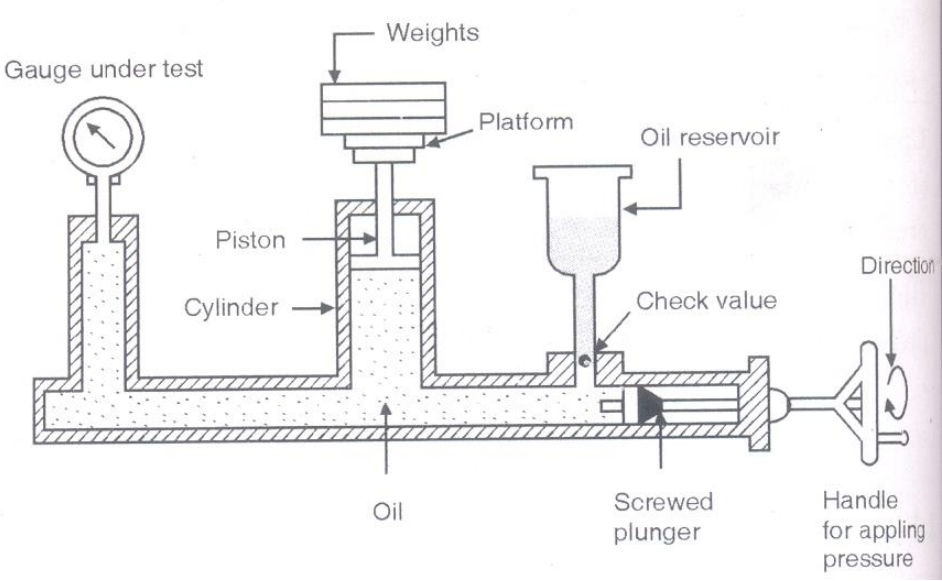
01 M for each point

Sr No.	PTC	NTC
1	It is positive temperature coefficient	It is negative temperature coefficient
2	As temperature increases, resistance increases $R \propto T$	As temperature increases resistance decreases $R \propto \frac{1}{T}$
3	Examples of materials with PTC include barium titanate, titanium oxide and powdered barium carbonate	Examples of materials with NTC include metal oxides such as Manganese, nickel, cobalt, copper, iron and uranium.
4		

SUMMER- 18 EXAMINATION

Subject Name: Industrial Measurements Model Answer

Subject Code: 17434

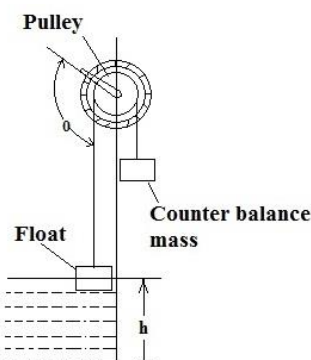
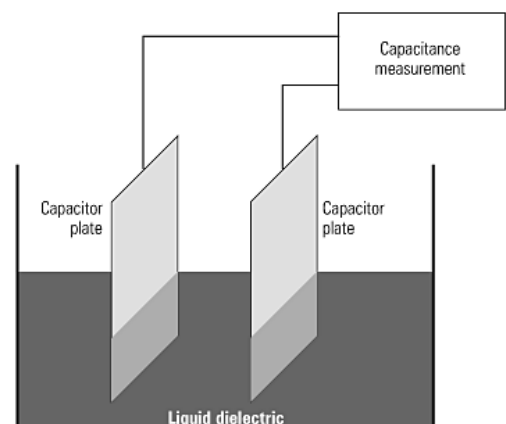
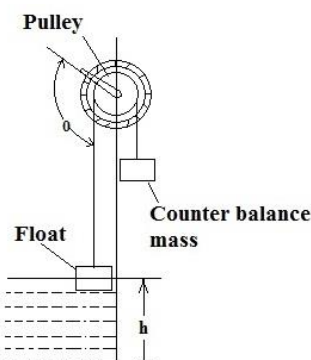
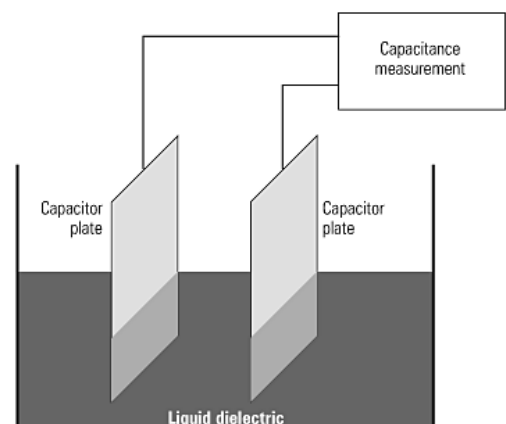
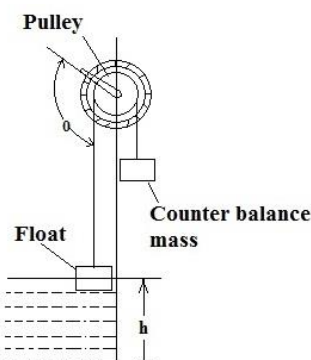
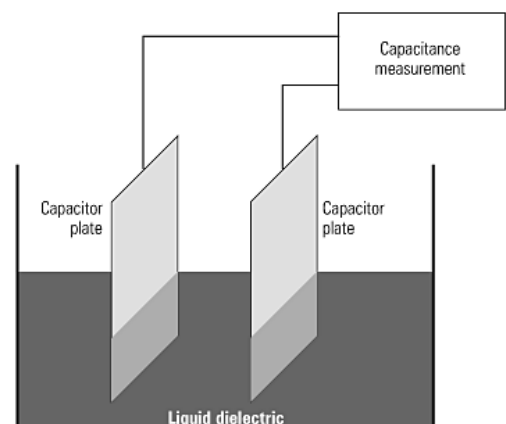
d	<p>What is pressure calibration? State stepwise procedure to test the accuracy of pressure gauge with dead weight tester.</p>	4M
<p>Ans :</p>	<p>Pressure Calibration:</p> <p>It is the process of adjusting the instrument's output signal to match a known range of pressures.</p> <p>Calibration of a given pressure gauge can be done with the help of dead weight pressure gauge tester. In this method, the output of the given faulty or uncalibrated pressure gauge is compared with pre calibrated dead weight pressure and corrected.</p> <p>Diagram For Dead weight Pressure gauge tester:</p>  <p>Stepwise procedure:</p> <ul style="list-style-type: none"> • The handle of the dead weight tester is fully drawn out and the oil is allowed to enter in the cylinder (i.e. gauge and piston) • A known accurate weight is placed on the platform. The area of the piston is also known; hence we can calculate the pressure. • Now the handle is turned in clockwise direction so that the pressure will buildup on the gauge side as well as platform side. • The pressure is increased by rotating the handle clockwise until enough pressure is developed inside the cylinder to lift the platform with weights placed on it and it floats freely. • The procedure is repeated for different weights (increase weights in steps). In the same way most of the pressure gauges are calibrated against dead weight testers. 	<p>01 M</p> <p>Diagram 1½ M</p> <p>Procedure 1½ M</p>
e	<p>Differentiate between float type measurement and capacitive type measurement for level measurement.</p>	4M



SUMMER- 18 EXAMINATION

Subject Name: Industrial Measurements Model Answer

Subject Code: **17434**

Ans :		Any 4 Points 01 M each																		
	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 10%;">Sr.No.</th> <th style="width: 40%;">Float Type level Measurement</th> <th style="width: 50%;">Capacitive type Level Measurement</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">1</td> <td>This method provides non electrical output signal</td> <td>This method provides an electrical output signal</td> </tr> <tr> <td style="text-align: center;">2</td> <td> Diagram:  Liquid level measurements using float </td> <td> Diagram:  Liquid dielectric </td> </tr> <tr> <td style="text-align: center;">3</td> <td>Range for conducting type liquid: 100ft (30m)</td> <td>Range for conducting type liquid: 12ft</td> </tr> <tr> <td style="text-align: center;">4</td> <td>Range for Non conducting liquid: 200ft (60m)</td> <td>Range for Non conducting liquid: 8 ft.</td> </tr> <tr> <td style="text-align: center;">5</td> <td>Comparatively less costly method</td> <td>Comparatively more costly method</td> </tr> </tbody> </table>	Sr.No.	Float Type level Measurement	Capacitive type Level Measurement	1	This method provides non electrical output signal	This method provides an electrical output signal	2	Diagram:  Liquid level measurements using float	Diagram:  Liquid dielectric	3	Range for conducting type liquid: 100ft (30m)	Range for conducting type liquid: 12ft	4	Range for Non conducting liquid: 200ft (60m)	Range for Non conducting liquid: 8 ft.	5	Comparatively less costly method	Comparatively more costly method	
Sr.No.	Float Type level Measurement	Capacitive type Level Measurement																		
1	This method provides non electrical output signal	This method provides an electrical output signal																		
2	Diagram:  Liquid level measurements using float	Diagram:  Liquid dielectric																		
3	Range for conducting type liquid: 100ft (30m)	Range for conducting type liquid: 12ft																		
4	Range for Non conducting liquid: 200ft (60m)	Range for Non conducting liquid: 8 ft.																		
5	Comparatively less costly method	Comparatively more costly method																		
f	What is pyrometry? Describe working of optical pyrometer with neat diagram.	4M																		
Ans :	<p>Pyrometer: -</p> <p>When physical contact with the medium to be measured is not possible or impractical due to very high temperature (above 1400oC) pyrometers are used for temperature measurement.</p> <p style="text-align: center;">(Or)</p> <p>Pyrometry is the technique of measuring temperature of a body without actual physical contact.</p> <p>Diagram of Optical Pyrometer:</p>	01 M																		

SUMMER- 18 EXAMINATION

Subject Name: Industrial Measurements Model Answer

Subject Code: 17434

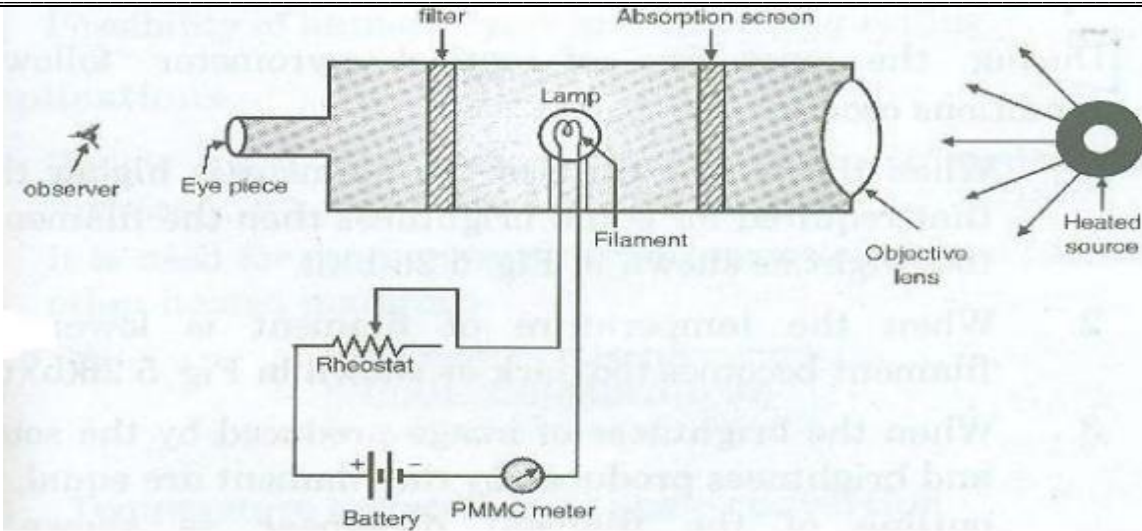
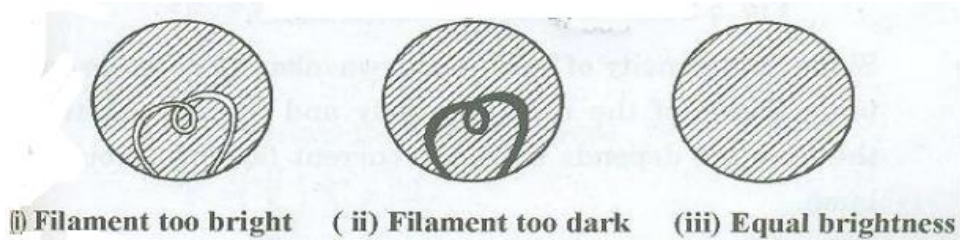


Diagram
1½ M

Fig: Optical pyrometer



The working principle of optical pyrometer can be stated that the brightness of light of a given color emitted by a hot source, gives an indication of temperature.

Working:

- It consists of a tube, one end of this tube has objective lens and other end has a sighting eye piece to observe the filament.
- The filament is viewed through filter and eye piece. The lens side of tube is projected towards the hot body whose temperature is to be measured.
- An image of radiating source is produced by a lens and made to coincide with the filament of an electric lamp.
- The current through the lamp filament is made variable so that lamp intensity can be adjusted. The current through filament is adjusted until the filament and the image are of equal brightness.

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(i).
- 2) When the temperature of filament is lower, the filament becomes too dark as shown in fig(ii)
- 3) When the brightness of image produced by the source and brightness produced by the filament are equal, the outline of the filament disappears figure (iii)

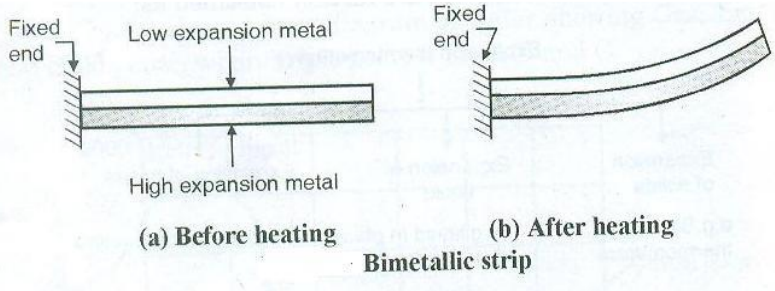
1½ M



SUMMER- 18 EXAMINATION

Subject Name: Industrial Measurements Model Answer

Subject Code: 17434

b	Explain working principle of bimetallic thermometer.	4M
Ans :	 <p>Working principle:</p> <p>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.</p> <p>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 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.</p> <p>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.</p> <p>Pointer is attached to the free end to indicate the temperature</p>	Working principle-4M
c	State two advantages and two disadvantages of radiation type level measurement.	4M
Ans :	Advantages: 1. Quite suitable for large reservoirs of 30-40 m diameter. 2. Continuous measurement is possible.	Advantages-2M



SUMMER- 18 EXAMINATION

Subject Name: Industrial Measurements Model Answer

Subject Code: 17434

	<p>3. Non-contact device.</p> <p>4. Measurement is independent on temperature, pressure, corrosion, etc.</p> <p>5. Rigid construction and withstand severe operating conditions.</p> <p>Disadvantages :-</p> <p>1. It is risky to use this method due to radiation effects.</p> <p>2. Adequate shielding is required to limit the radiation field intensity</p>	<p>Disadvantages -2M</p>
d	<p>State two advantages and two drawbacks of liquid filled and gas filled thermometer.</p>	<p>4M</p>
Ans :	<p>Liquid filled thermometer</p> <p>Advantages:</p> <p>1) They are comparatively cheaper than other temperature measurement devices.</p> <p>2) They are handy and convenient to use.</p> <p>3) Unlike electrical thermometers, they do not necessitate power supply or batteries for charging.</p> <p>Disadvantages :</p> <p>1) Limited to applications where manual reading is acceptable, e.g. a household thermometer.</p> <p>2) Have a limited useable temperature range.</p> <p>Gas filled thermometer</p> <p>Advantages:</p> <p>1) Gas thermometers have wide range of temperature.</p> <p>2) Permanent gases have close resemblance with perfect gas. Therefore, the thermometers filled with Permanent gases give the reading close to thermodynamic scale.</p> <p>Disadvantages :</p> <p>1) Larger bulb size.</p> <p>2) Generates less deflection force for controlling device.</p>	<p>1 mark for advantage</p> <p>1 mark for disadvantage</p> <p>1 mark for advantage</p> <p>1 mark for disadvantage</p>



SUMMER– 18 EXAMINATION

Subject Name: Industrial Measurements Model Answer

Subject Code: **17434**

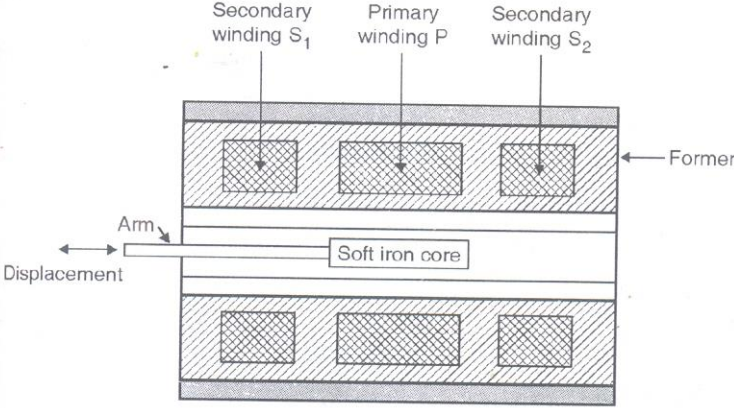
	e	Explain the need of level measurement.	4M																				
	Ans :	Need of level measurement: In almost all industries, vast quantities of liquids such as water, solvents, chemicals etc. are used in number of processes. Liquid level measurements are widely employed to monitor as well as measure quantitatively the liquid content in the tanks, containers, vessels, reservoirs or liquid columns. The liquid level affects both pressure and rate of flow in and out of the container and therefore its measurement/ control becomes important in maintaining the overall process conditions. Hence improved level measurement accuracy makes it possible to reduce chemical-process variability, resulting in higher product quality, reduced cost, and less waste.	4 M																				
	f	Compare RTD and thermistor on the basis of temperature coefficient , linearity, temperature range and cost.	4M																				
	Ans :	<table border="1"> <thead> <tr> <th>Sr.No</th> <th>Parameters</th> <th>RTD</th> <th>Thermistors</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Temperature coefficient</td> <td>It has positive temperature Coefficient (PTC) of Resistance.</td> <td>It has both positive and negative temperature Coefficient (PTC and NTC) of Resistance.</td> </tr> <tr> <td>2</td> <td>linearity</td> <td>It is Linear</td> <td>It is non Linear</td> </tr> <tr> <td>3</td> <td>Temperature range</td> <td>-270oC to 2800oC</td> <td>-150oC to 300oC</td> </tr> <tr> <td>4</td> <td>Cost</td> <td>High cost</td> <td>Low cost</td> </tr> </tbody> </table>	Sr.No	Parameters	RTD	Thermistors	1	Temperature coefficient	It has positive temperature Coefficient (PTC) of Resistance.	It has both positive and negative temperature Coefficient (PTC and NTC) of Resistance.	2	linearity	It is Linear	It is non Linear	3	Temperature range	-270oC to 2800oC	-150oC to 300oC	4	Cost	High cost	Low cost	1 mark for each point
Sr.No	Parameters	RTD	Thermistors																				
1	Temperature coefficient	It has positive temperature Coefficient (PTC) of Resistance.	It has both positive and negative temperature Coefficient (PTC and NTC) of Resistance.																				
2	linearity	It is Linear	It is non Linear																				
3	Temperature range	-270oC to 2800oC	-150oC to 300oC																				
4	Cost	High cost	Low cost																				
Q. No .	Sub Q. N.	Answers	Marking Scheme																				
4		Attempt any FOUR:	12- Total Marks																				
	a	Draw construction diagram of LVDT with label. Also state the application of LVDT.	4M																				



SUMMER- 18 EXAMINATION

Subject Name: Industrial Measurements Model Answer

Subject Code: 17434

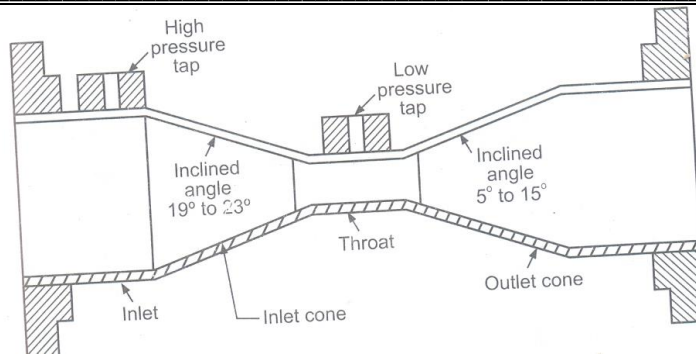
<p>Ans :</p>	 <p>Application of LVDT</p> <ol style="list-style-type: none"> 1) L.V.D.T as a primary transducer can be used for displacement measurement ranging from fraction of a mm to a few cm 2) Acting an secondary transducer, used to measure force, weight and pressure. 	<p>Diagram-2M</p> <p>Application 2M</p>
<p>b</p>	<p>State two advantages and two disadvantages of photoelectric pick-up speed measurement method.</p>	<p>4M</p>
<p>Ans :</p>	<p>Advantages :</p> <ol style="list-style-type: none"> 1) It is digital instrument so high accuracy. 2) Pulse amplitudes are constant. 3) This simplifies the electronic circuitry. <p>Disadvantages :</p> <ol style="list-style-type: none"> 1) Light source must be replaced time to time. 2) The accuracy depends on the error represented by one pulse. 	<p>Advantages-2M</p> <p>Disadvantages -2M</p>
<p>c</p>	<p>Describe working of venturimeter with neat sketch.</p>	<p>4M</p>
<p>Ans :</p>		<p>Diagram-2M</p>



SUMMER- 18 EXAMINATION

Subject Name: Industrial Measurements Model Answer

Subject Code: 17434



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 α_1 which may be between 19o to 23o.

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 α_2 which may be between 5o to 15o.

Flow rate is proportional to the square root of the differential pressure.

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

Working-2M

d What is tachometer ? Explain photo electric pick-up.

4M

Ans : Tachometer is an instrument which is used to measure angular speed. It is measured in revolutions per minutes (RPM).

Definition-1M

Working with



SUMMER- 18 EXAMINATION

Subject Name: Industrial Measurements Model Answer

Subject Code: 17434

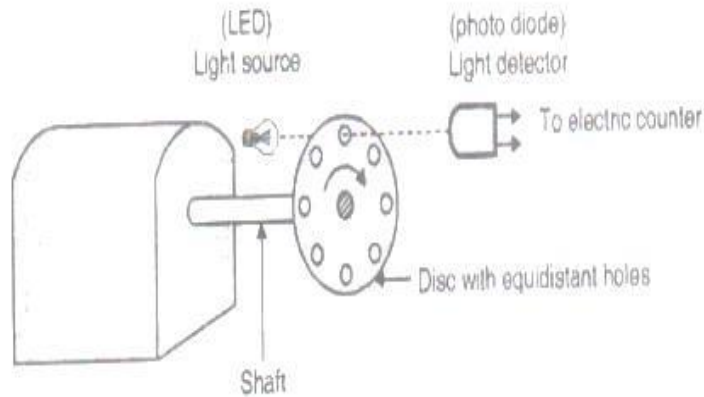


diagram-3M

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 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

$$N = f / H_s$$

$$N = \text{speed}$$

$$f = \text{frequency}$$

$$H_s = \text{holes on the disc}$$

e What is a psychrometer ? Draw neat diagram of sling type hygrometer.

4M

Ans : Psychrometers are instruments used for measuring relative humidity.

Definition-1M

SUMMER- 18 EXAMINATION

Subject Name: Industrial Measurements Model Answer

Subject Code: 17434

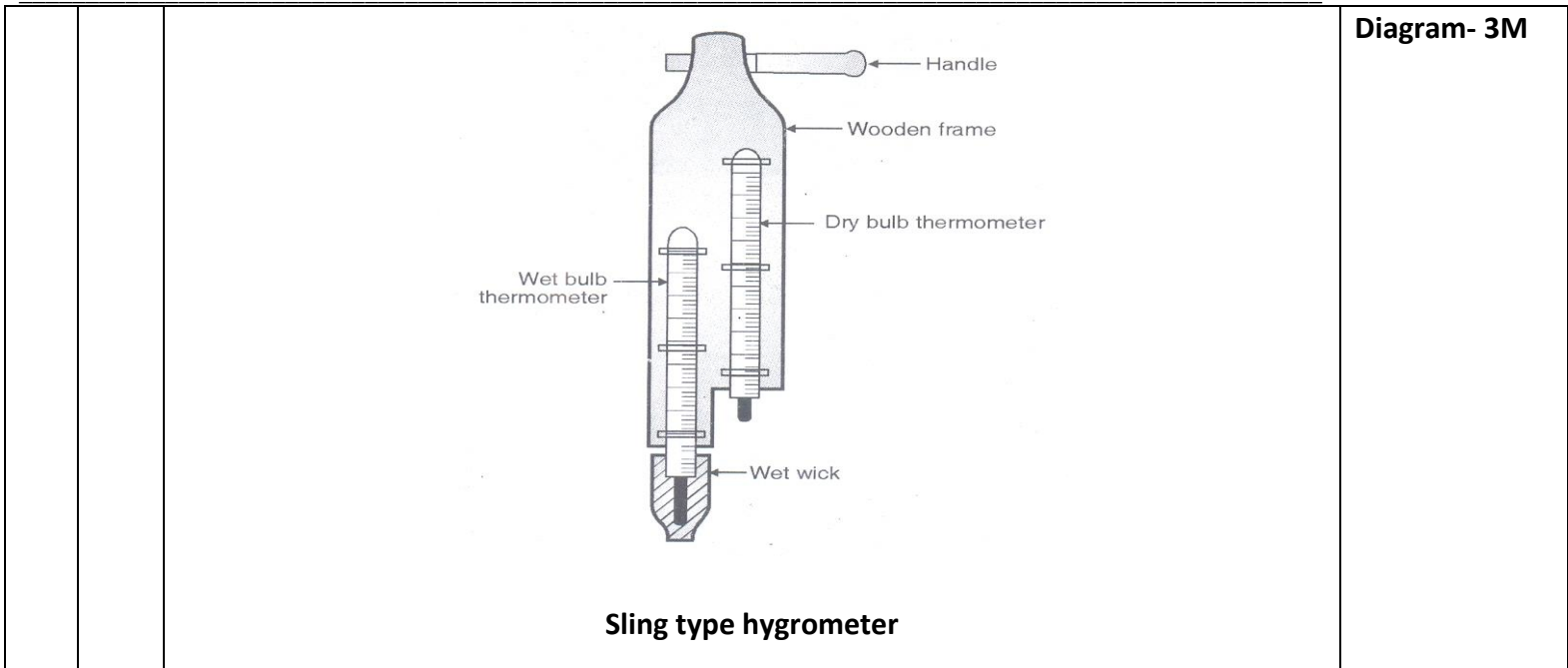


Diagram- 3M

f Describe working principle of ultrasonic level detector with diagram.

4M

Ans :

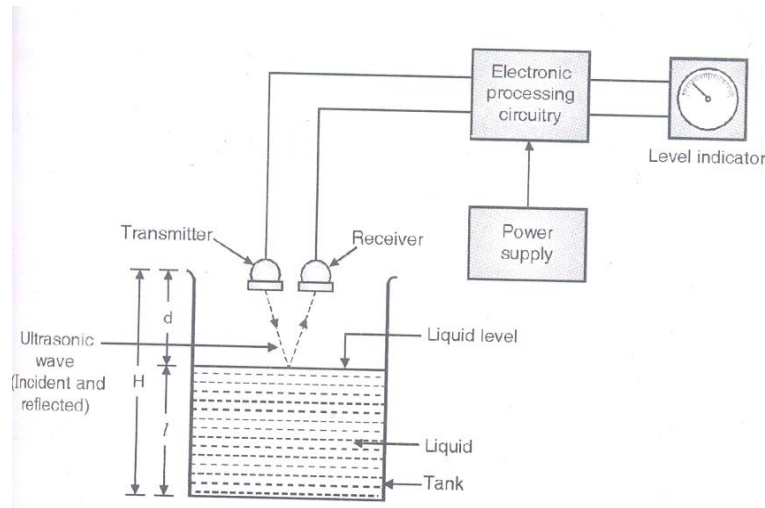


Diagram-2M

Working principle

It operates by generating an ultrasonic wave or pulse and measuring the time it takes for the echo to return. An ultrasonic transmitter receiver along with the necessary signal conversion unit is mounted on top of tank for measurement of level of either solids or liquids as shown in figure. The ultrasonic waves generated by transmitter are directed towards the liquid surface in the tank which is to be measured. These waves

Working-principle
2M



SUMMER– 18 EXAMINATION

Subject Name: Industrial Measurements Model Answer

Subject Code: 17434

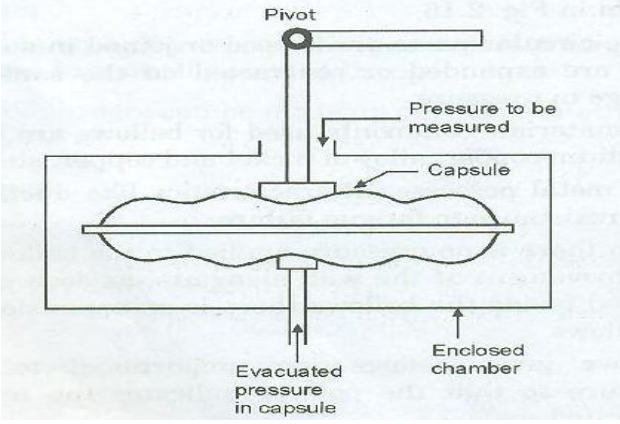
get reflected from the surface of the liquid and are received by the receiver. The time taken by the wave during its travel is a measure of the distance travelled by the wave. Therefore the time 't' between transmitting and receiving a wave is proportional to the distance 'd' between ultrasonic set and surface of the liquid in the tank. As the distance 'H' between ultrasonic set and the bottom of the tank is fixed time 't' becomes a measure of level 'l' i.e.,
 $t \propto d \propto (H-l)$.

Q. No.	Sub Q. N.	Answers	Marking Scheme															
5		Attempt any FOUR:	16- Total Marks															
	a	Compare active and passive transducer. (any 4 points)	4M															
	Ans :	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 10%;">Sr No</th> <th style="width: 35%;">Active Transducer</th> <th style="width: 35%;">Passive Transducer</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">1</td> <td>Operate under energy conversion principle.</td> <td>Operate under energy controlling principle.</td> </tr> <tr> <td style="text-align: center;">2</td> <td>Ex. Thermocouple, Piezoelectric Transducer</td> <td>Ex. Thermistors, Strain Gauges</td> </tr> <tr> <td style="text-align: center;">3</td> <td>Do not require external power supply for its operation.</td> <td>Require external power supply for its operation.</td> </tr> <tr> <td style="text-align: center;">4</td> <td>They produce an electrical signal proportional to the input physical quantity.</td> <td>They produce an output signal in the form of some variation in resistance, capacitance or any other electrical parameter, which has to be converted to an equivalent current or voltage signal.</td> </tr> </tbody> </table>	Sr No	Active Transducer	Passive Transducer	1	Operate under energy conversion principle.	Operate under energy controlling principle.	2	Ex. Thermocouple, Piezoelectric Transducer	Ex. Thermistors, Strain Gauges	3	Do not require external power supply for its operation.	Require external power supply for its operation.	4	They produce an electrical signal proportional to the input physical quantity.	They produce an output signal in the form of some variation in resistance, capacitance or any other electrical parameter, which has to be converted to an equivalent current or voltage signal.	1 M each
Sr No	Active Transducer	Passive Transducer																
1	Operate under energy conversion principle.	Operate under energy controlling principle.																
2	Ex. Thermocouple, Piezoelectric Transducer	Ex. Thermistors, Strain Gauges																
3	Do not require external power supply for its operation.	Require external power supply for its operation.																
4	They produce an electrical signal proportional to the input physical quantity.	They produce an output signal in the form of some variation in resistance, capacitance or any other electrical parameter, which has to be converted to an equivalent current or voltage signal.																
	b	Convert 280 mm of Hg pressure level in bars, psi, kilopascal and microns.	4M															
	Ans :	<p>1psi= 51.71484 mm of Hg, Or, 1 mmHg = 0.019336 psi Therefore, 280 mm of Hg = 5.414 psi</p> <p>1 bar = 750.063mm of Hg Or, 1 mmHg = 0.0013332 bar Therefore , 280 mm of Hg =0 .3733 bar</p> <p>1 mmHg=0.133322387415 kilopascals Therefore, 280 mmHg = 37.33 kilopascals 1mmHg = 1000 microns ,Therefore, 280 mmHg = 2,80,000 microns</p>	1M each															

SUMMER- 18 EXAMINATION

Subject Name: Industrial Measurements Model Answer

Subject Code: **17434**

c	What is capsule? How it is used for pressure measurement?			4M
Ans :				2 M- diagram
	<ul style="list-style-type: none"> A capsule is made up of two identical corrugated diaphragms so as to form a leak- proof chamber and also referred to as an aneroid. The fluid under measurement is entered in to the chamber. One diaphragm is rigidly held while other deflects and results in twice the displacement of single diaphragm. The central part of diaphragm consists of a round disc which serves on one side to communicate the displacement. The opening is provided in other diaphragm to apply the pressure. 			2M- explanation
d	Compare contact type and non-contact type speed measurement method.			4M
Ans :	Sr.no	Contact type method	Non contact type method	Any 4 points- 1 mark each
	1	Physical contact between meter and shaft	No Physical contact between meter and shaft	
	2	Consists of moving parts	Does not consist of moving parts	
	3	Output is electrical signal	Output has to be converted to electrical signal	
	4	Optical transducer is not used	Optical transducer is used	
	5	ADC is required	ADC is not required	
	6	Maintenance is more due to the moving parts	Maintenance is less	
	7	Ex.AC / DC tachometer	Ex. Rotary Encoder, Photo electric tachometer	
e	Compare thermo- couple and thermistor.			4M



SUMMER- 18 EXAMINATION

Subject Name: Industrial Measurements Model Answer

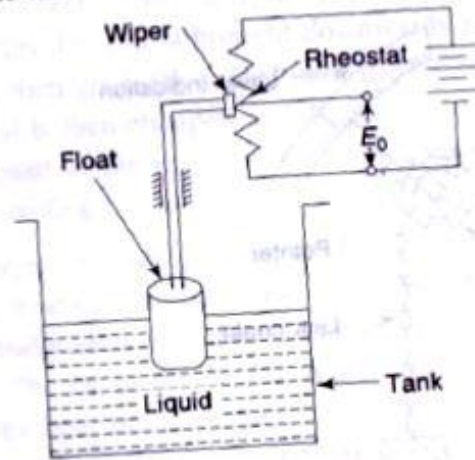
Subject Code: **17434**

Ans :	Parameter	Thermocouple	Thermistor	Any 4, 1 mark each
	Materials	Two dissimilar metals	Metal oxides	
	Response	Linear	Nonlinear	
	Range of temperature	-200 °C to 2000 °C	-150°C to 300°C	
	Size	Large as compared to thermistor	Small in size	
	Whether active or passive	Active	Passive	
	Transduction principle	Thermo electric effect	Resistive transducer	
f	Sketch constructional diagram of the operation of electromagnetic flow meter. State its two limitations.			
Ans :				2M for diagram
	<p>Limitations:</p> <ol style="list-style-type: none"> 1. It is used only for liquids. 2. It is not suitable for low velocity. 3. It is more expensive. 4. It is suitable for fluids having conductivity greater than 20 micro ohm/cm. 5. Gas inclusion cause errors. 6. Difficulties in on site calibration 			1M each for any two limitations
Q. No.	Sub Q. N.	Answers		Marking Scheme
6		Attempt any FOUR:		16- Total Marks
a		Compare between U tube and well type manometers. (any 4)		4M

SUMMER- 18 EXAMINATION

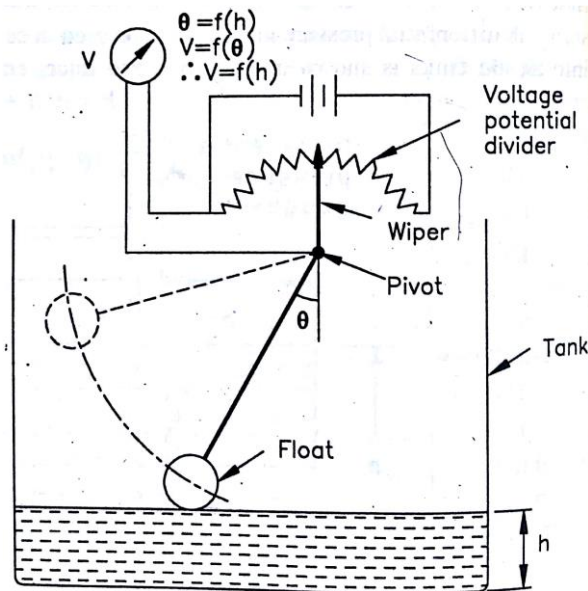
Subject Name: Industrial Measurements Model Answer

Subject Code: 17434



(a) Linear potentiometer liquid level gauge

Diagram of rotary potentiometer liquid level gauge:



Note: Any other relevant diagram may be considered.

2M

d Draw neat diagram of gas filled thermometer. State its operating range and material used.

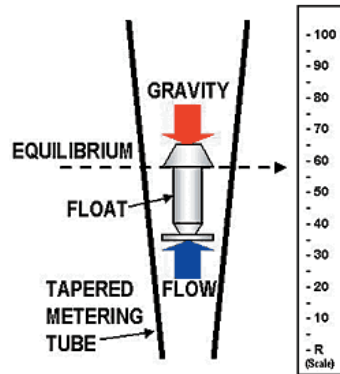
4M

SUMMER- 18 EXAMINATION

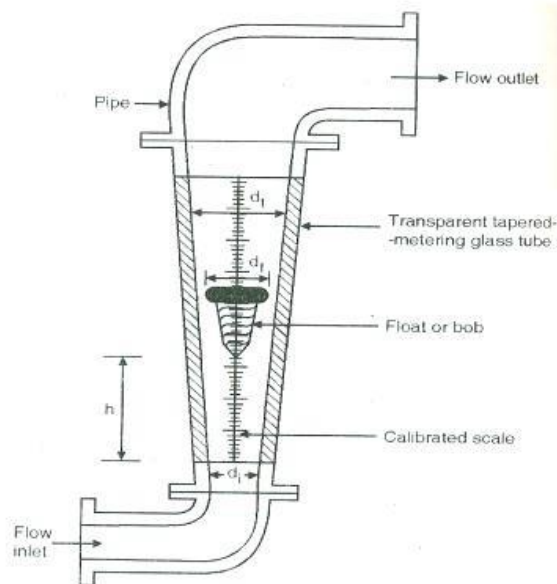
Subject Name: Industrial Measurements Model Answer

Subject Code: 17434

Ans
:



(OR)



Rotameter is called as a variable area flow meter because in rotameter the area is varied i.e, bottom area is small and it increases towards top, to maintain steady pressure difference. When there is no flow through the Rota meter, the float rests at the bottom of metering tube. When fluid enters the tube, the float moves up and the flow area increases. The float moves up until the lifting force produced by flow and gravitational force acting on the float reach an equilibrium. Thus, the differential pressure and lifting force increase with rise in flow rate. A calibrated scale is printed on the tube. With the help of float position and calibrated scale, we can measure the flow rate.

2M for
diagram

2M for
explanation