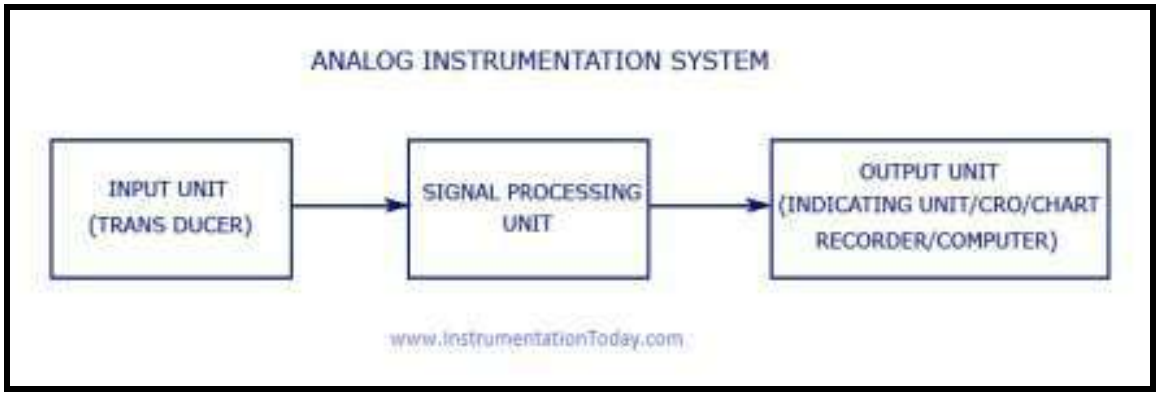
Important Instructions to examiners:
1) The answers should be examined by key words and not as word-to-word as given in the model answer scheme.
2) The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate.
3) The language 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.1 Attempt any TEN: 20M

a) Draw block diagram of instrumentation system.

Ans: (Diagram- 2M)



OR

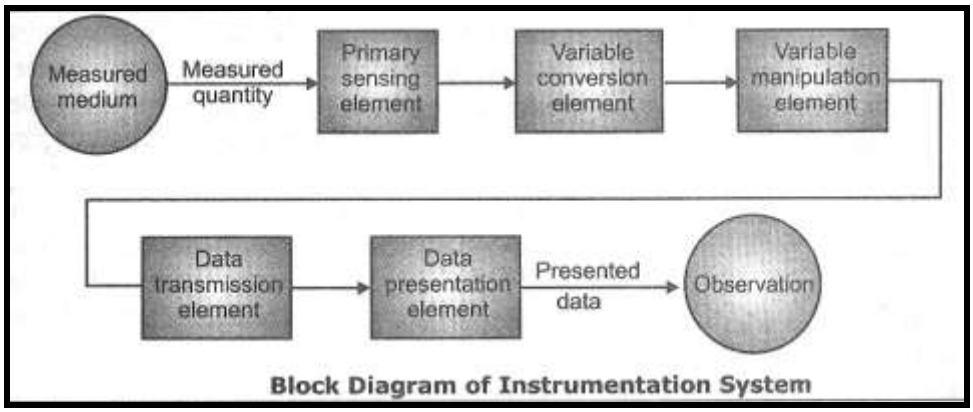


Fig. Block diagram of instrumentation system

b) What do you mean by static and dynamic characteristics of instrument?

Ans: (1 Mark each)

Static characteristic:

It is concerned only with steady state reading. Accuracy, precision, linearity, tolerance, static error, repeatability, calibration, static sensitivity etc. are examples of static characteristic.

Dynamic characteristics: Of an instrument describe its behavior between the time a measured variable changes value and the time when the instrument output attains a steady state value in response. Dynamic characteristic of an instrument is determined by giving predetermined signals to it such as step input, ramp input, and sinusoidal input.

c) What is range and Span of instrument?

Ans: (1 Mark each)

Span of instrument:

It can be defined as the range of an instrument from the minimum to maximum scale value.

OR

If in a measuring instrument the highest point of calibration is x_1 units and the lowest point is x_2 units, then the instrument span is given by

Span=(x_1-x_2) units

Range:

It can be defined as the measure of the instrument between the lowest and highest readings it can measure.

d) Define: i) sensitivity ii) Resolution

Ans: Definition: (1 Mark each)

Sensitivity:

The ratio of change in output of an instrument to the change in input is known as sensitivity.
Sensitivity = Change in output/ Change in input

Resolution:-

Resolution is the term used to describe the number of dots, or pixels, used to display an image. The smallest to be distinguished magnitude from the measured value.

OR

The smallest change in a measured variable to which an instrument will respond is called resolution.

e) What is calibration of instrument?

Ans:

Calibration: **1M**

- The process of deriving the value of a quantity by comparing that quantity with a standard quantity is called as calibration.
- Calibration of instrument is done to obtain correct unknown value of each scale reading on measuring instrument.

Need of calibration: **1M**

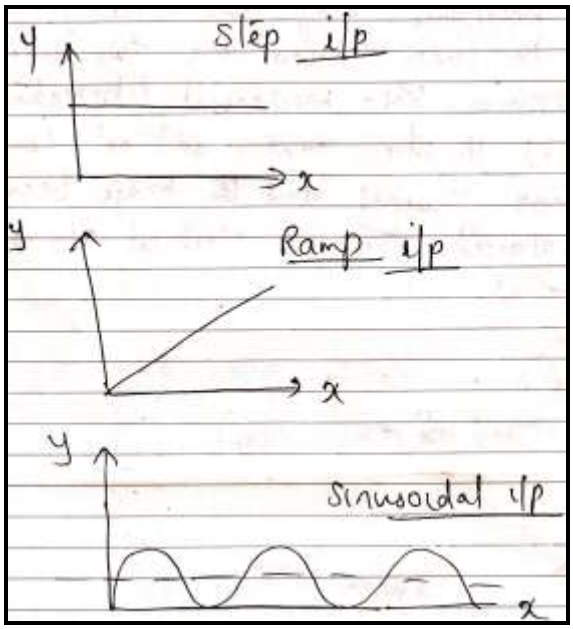
There are 3 main reasons for having instrument calibration:

- To ensure reading from an instrument are consistent with other measurements.
- To determine the accuracy of the instrument reading.
- To establish the reliability of the instrument i.e. it can be trusted.

f) Draw the step, ramp and sinusoidal inputs.

Ans: (Sinusoidal 1M, & other two waveforms ½ M)

Diagram:



g) Define the term transducer.

Ans: Definition: (2Marks)

Transducer:

Transducer is a device which converts one form of energy in to other form of energy.

h) List two active transducers.

Ans: (2Marks)

Active Transducers:

- Thermocouple.
- Piezo electric transducer

i) List two applications of active transducers.

Ans: (1 mark each)

Applications of active transducer:

- **Thermocouple** : To convert temperature to voltage
- **Piezo electric:** To convert pressure or force to voltage

j) Compare active and passive transducers.(Any two points)

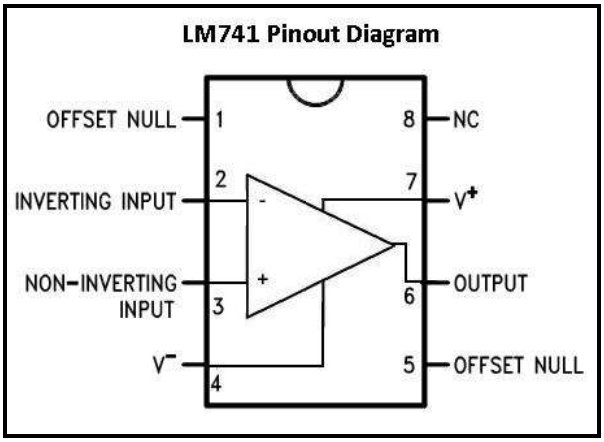
Ans:

Comparison:- (any 2-1M each)

Parameters	**Active**	**Passive**
Definition	It generates an electrical signal directly in response to a physical parameter and does not require an external electrical source	They operate under energy controlling principles which make it necessary to use an external electrical source.
Example	Thermocouple, Piezo electric Crystal	LDR, thermistor
Circuit	Simple	Complicated
Active Bridge	Not required	Required

k) Draw Pin diagram of IC 741.

Ans: Diagram: (2M)



OR

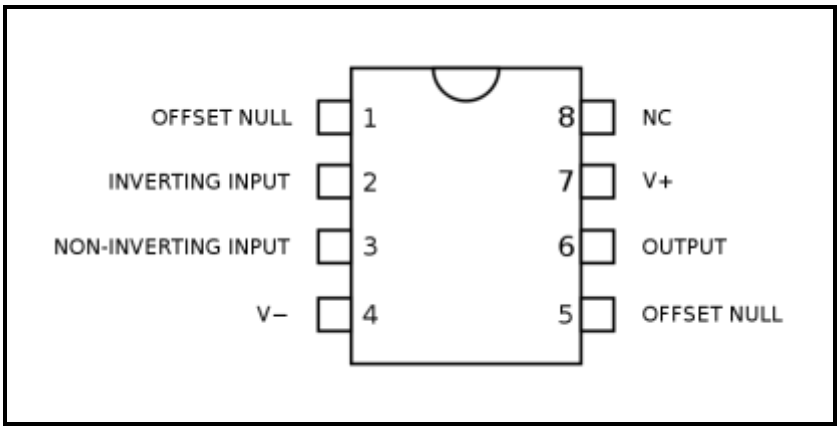


Fig. Pin diagram of IC 741

i) Define: -i) CMMR ii) SVRR

Ans: (01 M for each definition)
Definition:-

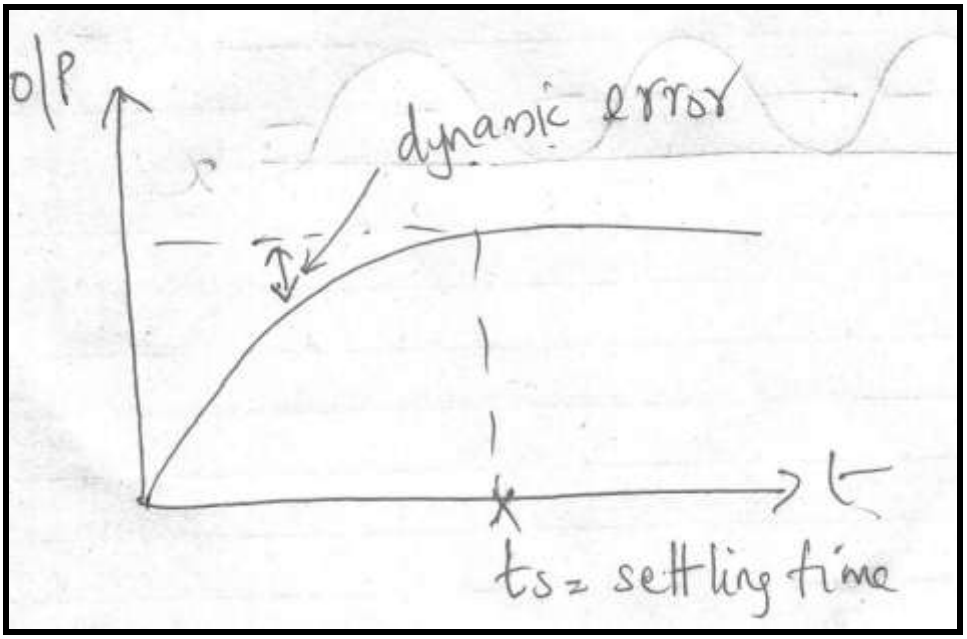
- **SVRR:**
  It is defined as the ratio of change of input offset voltage to the change in one supply voltage while keeping other supply voltage constant.
  Ideally, SVRR=0
- **CMMR:-**
  The CMRR is defined as the ratio of the powers of the differential gain over the common-mode gain, measured in positive decibels (thus using the 20 log rule): As differential gain should exceed common-mode gain, this will be a positive number, and the higher the better.

Q.2 Attempt any FOUR: 16M

a) What is dynamic error & settling time? Draw proper sketch.

Ans: (2mark-diagram, definition-1Mark each)

Diagram:



Definiton:

Dynamic error:

The dynamic error, d_e of a system can be defined as $d_e = \frac{y/k}{x} - 1$

And it represents a measure of the inability of a system to adequately reproduce the amplitude of the input signal for a particular input frequency. Measurement system with a magnitude ratio close to unity over the anticipated frequency band of the input signal is preferred to minimize d_e.

Settling time:

The characteristics that is useful in characterizing the speed of the response of any instrument is the settling time. This is the (after application of a step input) for the instrument to reach and stay within a tolerance band around its final value.

b) Define Accuracy & Precision with suitable example.

Ans: (definition-1 mark each, example-1Mark each)

Definition:

Accuracy:

It is the closeness which an instrument reading approaches the true value of the quantity being measured.

OR

The degree of exactness of a measurement compared to the expected value.

Example: The accuracy of a thermometer having a range of $500^{o}C$ may be expressed as ±0.5% of scale range. This means that the accuracy of the thermometer when the reading is $500^{o}C$ is ±0.5%.

Precision:

It is a measure of the reproducibility of the measurements that is given a fixed value of a quantity, precision of measure of the degree of agreement within a group of measurements.

OR

A measure of the consistency of measurements, i.e successive readings do not defer.

Example: Consider the measurement of a known voltage of 100V with a meter. Five readings are taken, and the indicated values are 104,103,105,103 and 105V from these value, it is seen that the instrument cannot be depended on for an accuracy better than 5% (5V in this case), while a precision of ±1% is indicated since the maximum deviation from the mean reading of 104V is only 1.0V.

c) Draw the Hall Effect transducer and explain the Hall Effect.

Ans: (diagram-2Marks, Explanation-2Marks)

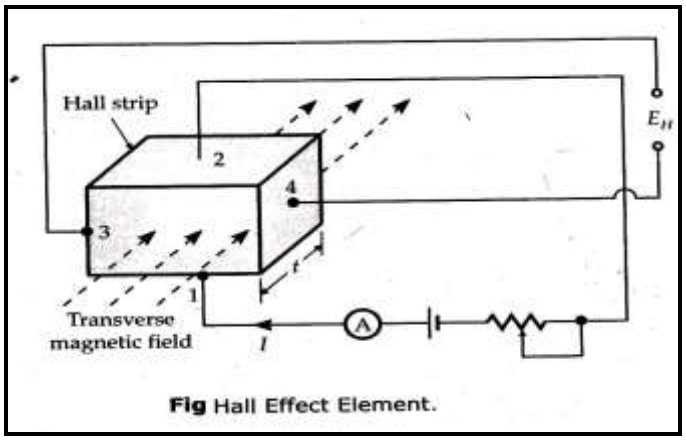
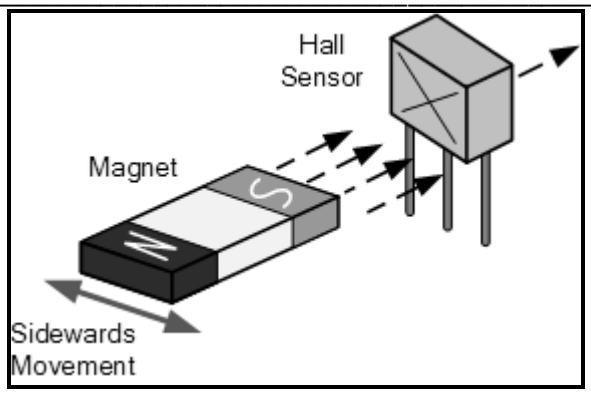


Fig Hall Effect Element.

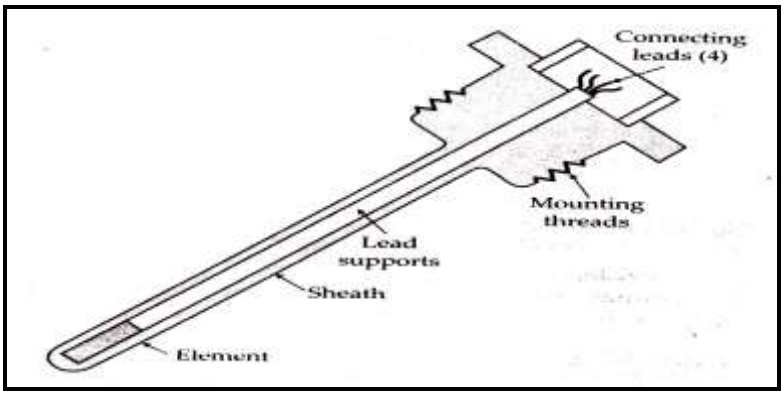
OR



Explanation:-

The principle of working of a Hall Effect Transducer is that if a strip of conducting material carries' a current in the presence of a transverse magnetic field, a difference of potential is produced between the opposite edges of the conductor. The magnitude of the voltage depends upon the current, the strength of magnetic field and the property of the conductor called Hall Effect.

d) Draw the diagram of RTD and state its working principle.
Ans: (diagram-2Marks, working-2Marks)
Diagram:



OR

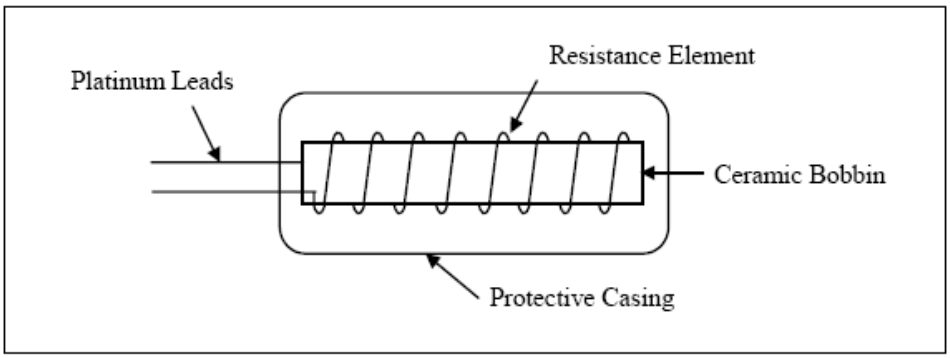


Fig. RTD

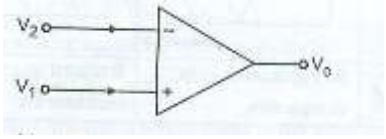
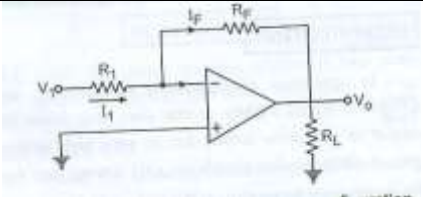
Resistance thermometer:

The resistance of a conductor changes when its temperature is changed. The resistance thermometer or RTD is an instrument used to measure electrical resistance in terms of temperature.

Variation of resistance of a metal with the temperature can be represented by the following relationship:

$$Rt = R0(1 + \alpha t + \beta t^2 + \gamma t^3 + \cdots)$$

e) Compare open loop and closed loop configuration of OP-AMP (any four points)
Ans: Comparison: (1 mark each)

Sr. No	Parameters	Open loop	Closed Loop
1	Circuit Diagram		
2	Gain	Voltage gain is very high	Voltage gain is low as compared to open loop.
3	Bandwidth	Bandwidth is low	Bandwidth is high
4	Application	Comparator	It is used in amplifier, oscillator etc.

f) Draw the circuit diagram of OP-AMP as integrator and give derivation for output voltage.
Ans: (diagram-2Marks, Derivation-2Marks)
Diagram:

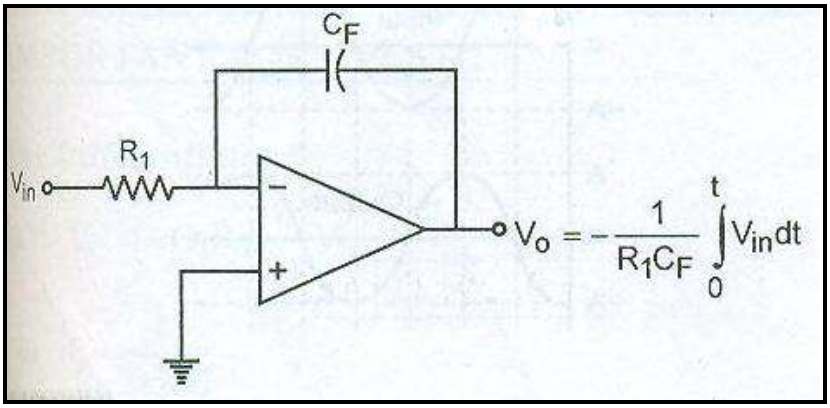


Fig.OP-AMP as integrator

Derivation:

To show that the circuit diagram shown in figure, acts as integrator, we use KCL at node v,

$$i_n = i_c$$

or $$\frac{v_- - v_1}{R} = C\frac{d}{dt}(v_0 - v_-)$$

For infinite differential gains, $v_- = 0$

$$\therefore \quad -\frac{v_1}{R} = C\frac{d}{dt}v_0$$

By integration, we get,

$$v_0 = -\frac{1}{RC}\int v_1\, dt$$

The convenient values R and C are in the MΩ and μF range respectively.

Q.3. Attempt any FOUR: 16M

a) With the help of mathematical expression describe dynamic response of zero order instruments.
Ans: (equation-2Marks, explanation-2Marks)

The simplest model for a measurement system is a zero-order differential equation

$$a_0\, y = b_0 x$$

Or

$$\mathbf{y} = \frac{b_0}{a_0}\, x = k_x$$

- In zero-order behavior the system output is considered to respond to the input signal instantly.
- A potentiometer is the example of a zero-order instrument.

b) Describe the working of strain gauge using Wheatstone configuration.
Ans: (working-2Marks, diagram-2Marks)

Diagram:

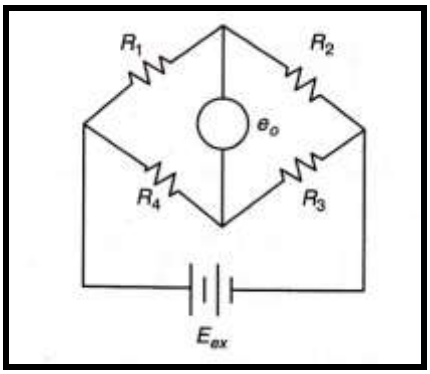


Fig. stain gauge.

Working:

- Four strain gauges are connected as four arms in Wheatstone's bridge.
- Two stain gauges will be under tension and two under compression.
- When mechanical deformation is applied, the strain gauges will get compressed or strained and the bridge becomes unbalanced. Thus the electrical output is obtained.

(Note: marks can be given for two arm configuration also)

c) Draw the schematic of electromagnetic Flow meter and explain its working.
Ans: (Diagram- 2Marks, Explanation -2Marks)
Diagram:

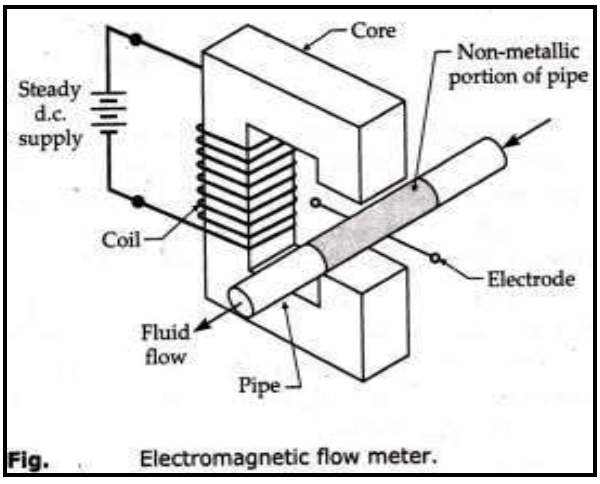


Fig. Electromagnetic flow meter.

Explanation:

- It consist basically of a pair of insulated electrodes buried flush in the opposite sides of a non- conducting , non-magnetic pipe carrying the liquid whose flow is to be measured.
- The pipe is surrounded by an electromagnet which produces a magnetic field. The arrangement is analogous to a conductor moving across a magnetic field. Therefore, voltage is included across the electrode. This voltage is given by:-

  E= *Blv* volt
  Where *B*= flux x density; Wb/m2,
  l = length of conductor = diameter of pipe; m,
  And *v* = Velocity of conductor (flow); m/s
- Thus, assuming a constant magnetic field, the magnitude of the voltage appearing across the electrode will be directly proportional to velocity.

d) Describe the working of Instrumentation amplifier. (Using 3 OP-AMP) with neat diagram.

Ans: (diagram-2Marks, working-2Marks)

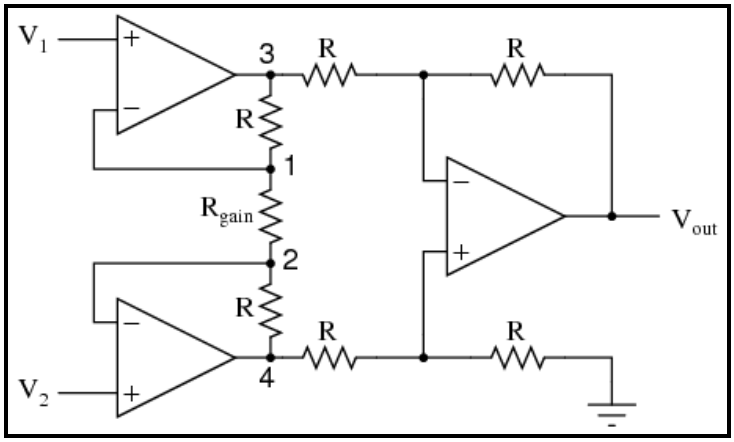


Fig. Instrumentation amplifier using 3 OP-AMP

- It is a differential amplifier with high input impedance.
- It consists of two stages.
- The first stage offers very high input impedance to the input signals. It consists of two opamps.
- The inputs V_1 and V_2 or applied to the non-inverting input terminal of the corresponding opamps. It is configured as voltage follower. The outputs of the two opamps are connected together through a string of resistors.
- The second stage is a differential amplifier with an output, negative feedback and ground connections.

e) Describe the Hot-Wire anemometer method for flow measurement using proper diagram.
Ans: (diagram-2Marks, Description-2Marks)

Diagram:

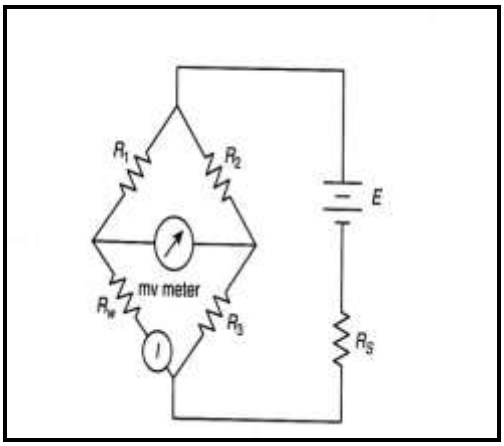


Fig. Hot-wire anemometer

Description:

There are two types of schematic arrangements for hot-wire anemometers:

- Constant current type
- Constant temperature type (or constant R_w type).

A constant current type hot-wire anemometer with measuring bridge circuit is shown in figure. The current is kept fixed at a certain value. The resistances R_1, R2, and R_3 are of the same order as Rw . The value of Rs is high. It is generally used to measure steady flow or low fluctuations in the velocity. It is not good for turbulent flow measurements.

Or

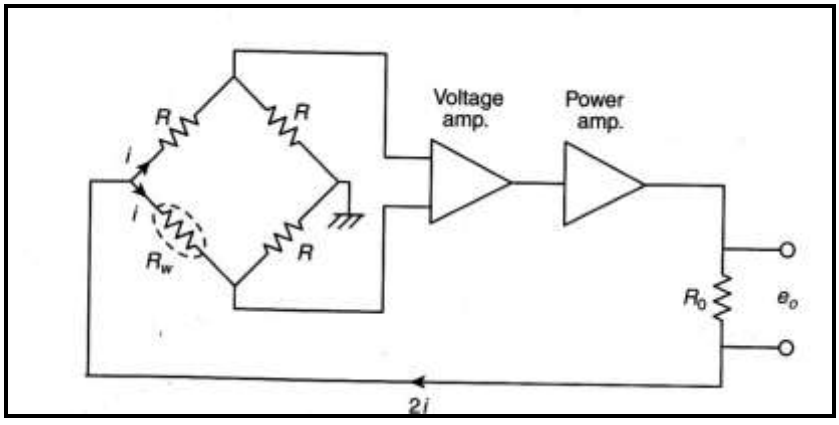


Fig. Hot-wire anemometer

A constant temperature type hot-wire anemometer is shown in figure. Here it keeps the resistance R_w constant by incorporating feedback. As the velocity increases, R_w decreases, thereby creating an unbalanced voltage. The increase of current brings back the resistance to the initial value. The feedback increases the bandwidth and therefore it is suitable for turbulent flow measurement also. The block diagram representation of constant temperature type is shown in figure below.

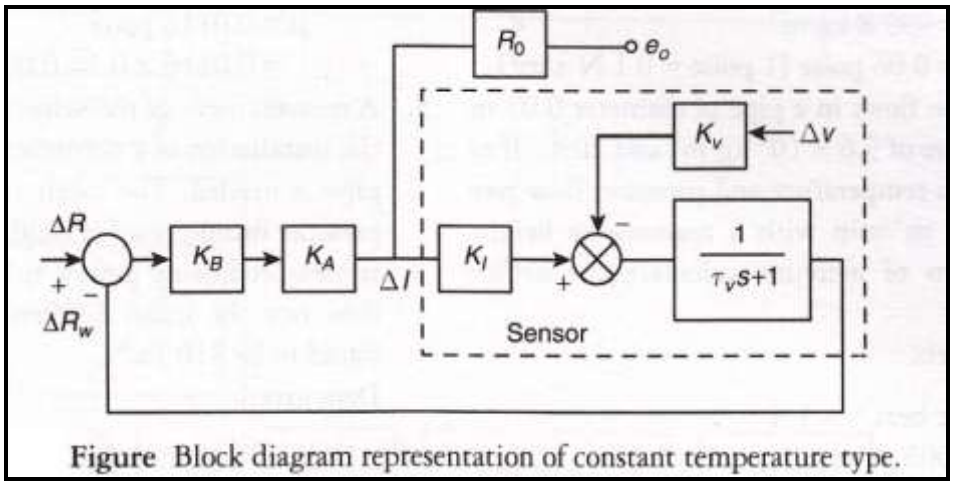


Figure Block diagram representation of constant temperature type.

f) Draw the Instrumentation System for displacement measurement using LVDT and describe its operation.

Ans: (diagram-2Marks, Working-2Marks)

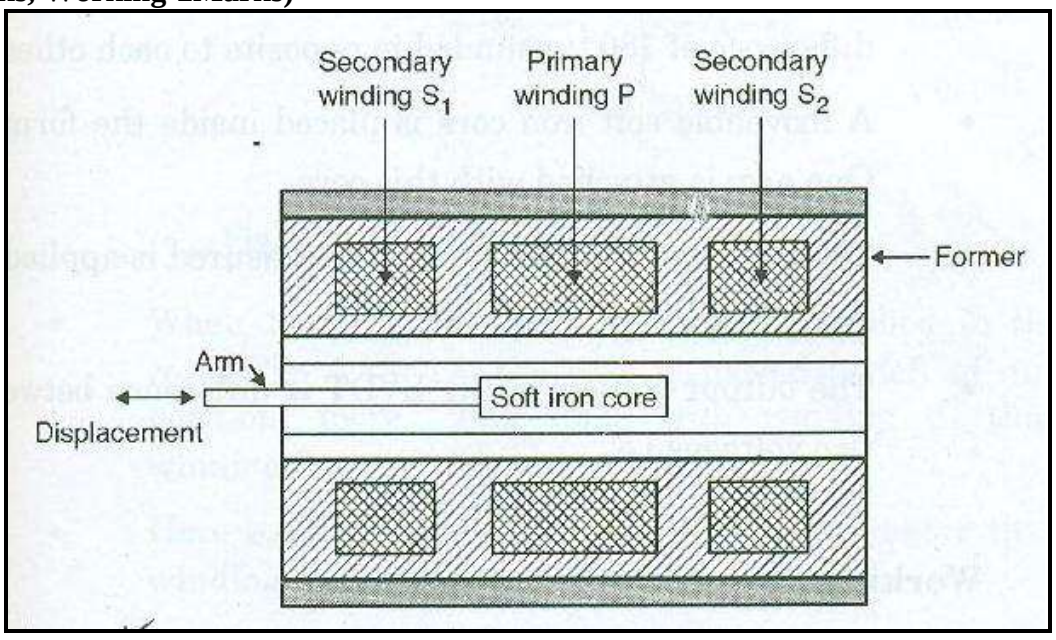


Fig. Instrumentation System for displacement measurement using LVDT

OR

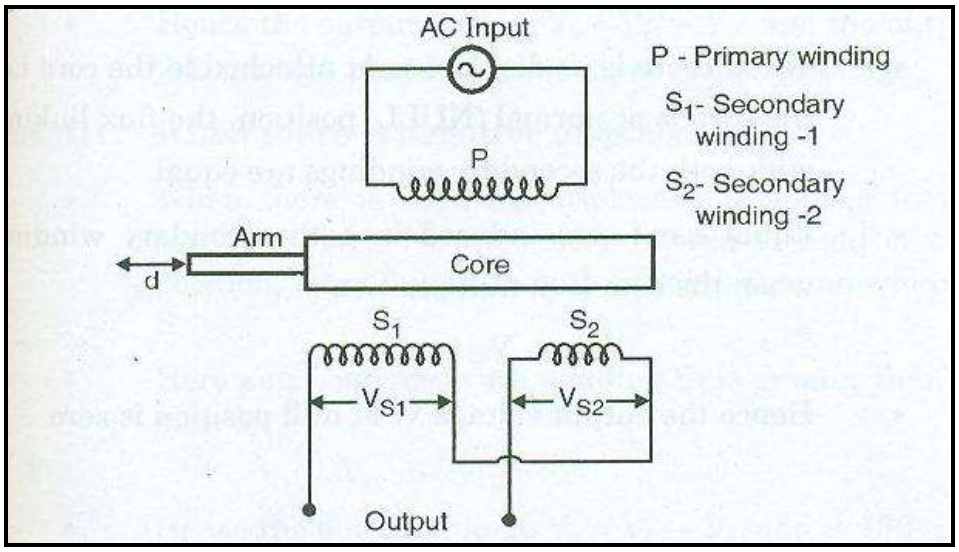


Fig. Instrumentation System for displacement measurement using LVDT

Working:

Case I: When there is no displacement.

When there is no displacement attached to the core the core is at normal position, the flux linking with both the secondary winding are equal.

Equal e.m.f. is induced in both secondary winding when the core is at null position:

$$VS1=VS2$$

Hence the output voltage Vo at null position is zero.

Case II: When there is positive displacement

When there is positive displacement applied to the core i.e. the core is moved to left of null position, more flux links with winding S1 than winding S2

Here e.m.f. induced with winding S1 is greater than winding S2 that is

$$VS1>VS2$$

Hence the output voltage Vo= VS1-VS2 and the output voltage is in phase with the input primary voltage.

Case III: When there is negative displacement

When there is negative displacement applied to the core i.e. the core is moved to right of null position, more flux links with winding S2 than winding S1.

Here e.m.f. induced with winding S2 is greater than S1 that is

$$VS2>VS1$$

Hence the output voltage Vo= VS1-VS2 and is 1800 out of phase with the input primary voltage.

4. Attempt any FOUR: 16M

a) Describe with neat labeled diagram for measurement of level using ultrasonic radiations.

Ans: (diagram-1Mark, lable-1Mark, Description-2Marks)

Description:

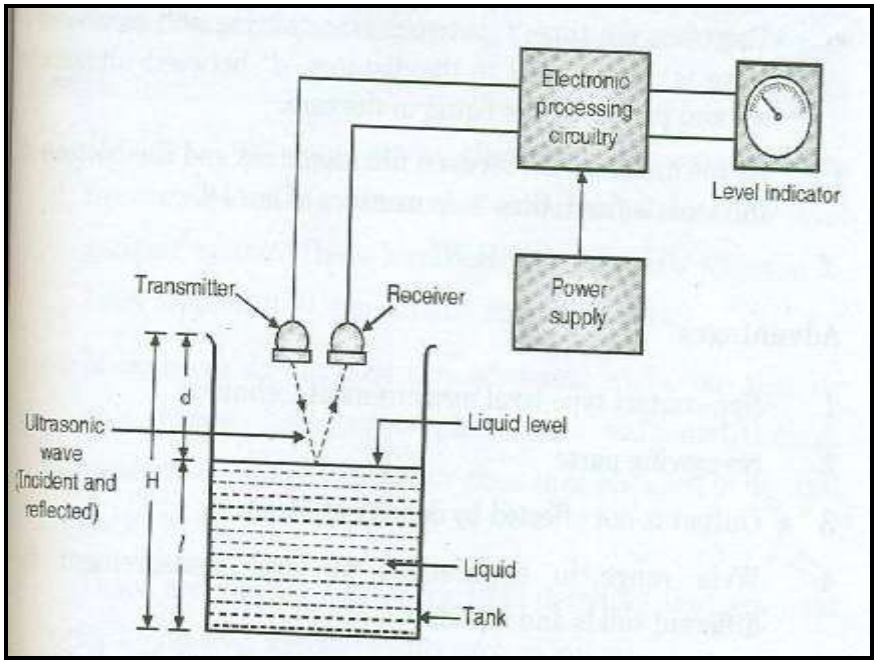


Fig. Diagram for measurement of level using ultrasonic radiations

Description:

It operates by generating an ultrasonic wave or pulse and measuring a time it takes for the echo to return.
There are two way of measurement of liquid level:

- Doppler Type
- Time difference type

- The ultrasonic waves generated by transmitter and directed towards the liquid surface in the tank which is to be measure.

These waves get reflected from the surface of the liquid and are received by the receiver. The time take by the wave 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’ is measure of level ‘l’

b) Define :i)Absolute pressure ii)Gauge pressure iii)Differential pressure iv)Pressure

Ans: (1mark each)

Definition:

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

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

Gauge pressure:

Gauge pressure is defined as the difference between absolute pressure and atmospheric pressure.

$$\text{Gauge pressure} = P_{Absolute} - P_{atmospheric}$$

Differential pressure:

Differential pressure is a pressure that is measured relative to the pressure in the atmosphere around it. It shows the difference between two pressures of the same unit.

Pressure:

Force applied on the surface per unit area. (Usually expressed in Newton/meter^2)

c) Draw the circuit diagram of voltage to current converter with floating load and explain its operation.

Ans: (diagram 2 mark, explanation 2 marks)

Figure shows the circuit of voltage to current (V to I) converter with floating load. This is also called as Tran’s conductance amplifier.

The circuit converts the voltage applied to the output current. Figure shows the V to I converter in which load resistor RL is floating i.e. its neither side is connected to ground since AV is large.

Diagram:

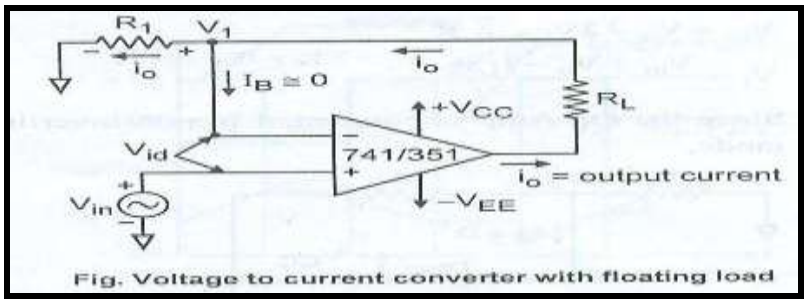


Fig. Voltage to current converter with floating load

Derivation:

V_{id}= 0 and this means

Vin= $V_1 = R_1 I_L$

Therefore, I_L = Vin/ R_1

Since I_L is load current through R_L at output, the input V_{in} is converted into an output current I_L = Vin/ R_1

d) What is DAS? Draw single channel DAS.

Ans: (definition 2 marks, diagram 2 marks)

Definition:

DAS: Data acquisition systems are, which is used to measure and record analog signals either in analog form or in digital form.

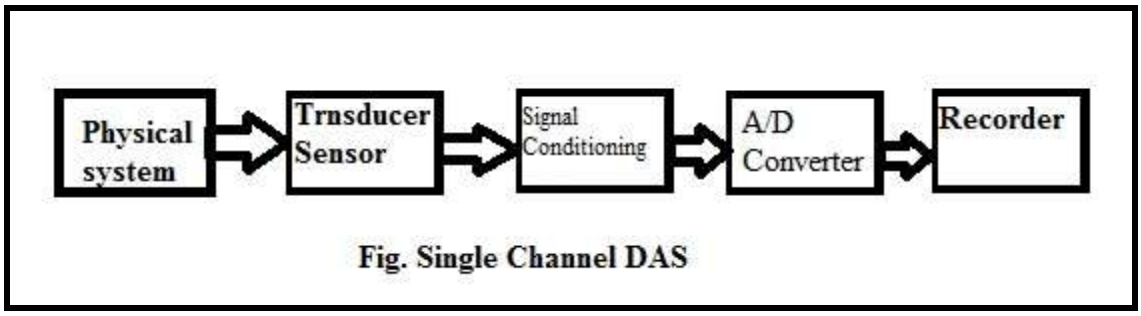


Fig. Single Channel DAS

e) Explain with neat diagram liquid level measurement by resistive sensor.

Ans: (explanation 2 marks, diagram 2 marks)

Diagram:

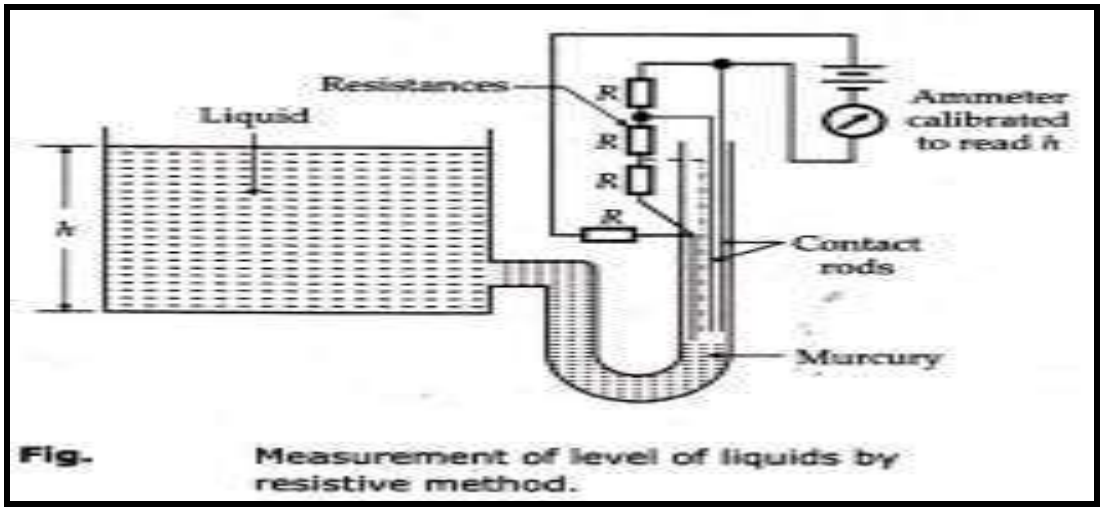


Fig. Measurement of level of liquids by resistive method.

This method uses mercury as a conductor. A number of conduct rods are placed at various liquid levels. As head h increases, the rising level of mercury above the datum, shorts successive resistors R and increases the value of h directly.

f) List any four factors that decide the configuration of DAS.

Ans: (1 mark each)

The factors that decide the configuration of DAS are as follows:

- Resolution and accuracy
- The number of channels to be monitored
- Sampling rate per channel
- Signal conditioning requirement of each channel, and
- cost

Q5. Attempt any FOUR: 16M

a) Define seeback and peltier effect.

Ans: Definition:

Seebeck effect: - **02M**

The Seebeck effect is a phenomenon in which a temperature difference between two dissimilar electrical conductors or semiconductors produces a voltage difference between the two substances. If the two conductors or semiconductors are connected together through an electrical circuit, direct current (DC) flows through that circuit.

Peltier effect: - **02M**

The Peltier effect is a temperature difference created by applying a voltage between two electrodes connected to a sample of conductor material. This phenomenon can be useful when it is necessary to transfer heat from one medium to another on a small scale.

b) Explain with neat diagram working of AC tachometer.

Ans:

Diagram: **02M**

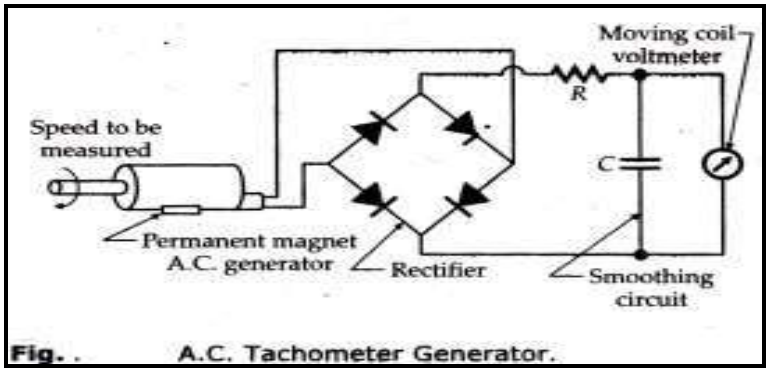


Fig. . A.C. Tachometer Generator.

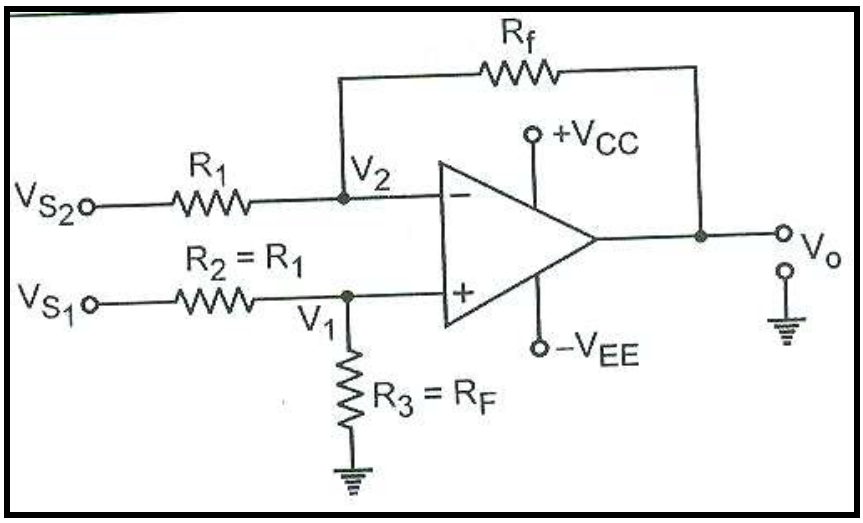
Explanation: - **02M**

The tachometer generator has rotating magnet which may be either a permanent magnet or an electromagnet .The coil is wound on the stator and therefore the problems associated with commutator (as in d.c tachometers) are absent.
The rotation of the magnet causes an emf to be induced in the stator coil . The amplitude and
frequency of this emf are both proportional to the speed of rotation. Thus either amplitude or frequency of induced voltage may be used as a measure of rotational speed.

c) Explain with the neat circuit diagram working of OP-amp as subtracter.
Ans: (explanation 2 marks, diagram 2 marks)
Explanation:
This circuit performs the subtraction of one signal from another with amplification if desired. In order to show that the voltage is proportional to difference in input voltages, we use superposition theorem since the circuit behaves linearly.
The output voltagebdue to V_1 alone (i.e., with $V_2 = 0$) is simply that of an inverting amplifier, and is equal to,

$$V_{o1} = -\left(\frac{R_{fn}}{R1}\right)V1$$

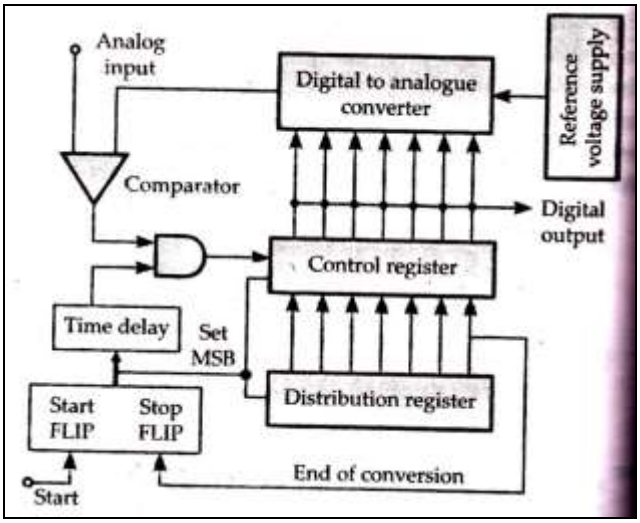
Diagram:



d) With neat ladled diagram explain the working of successive approximation type analog to digital converter.

Ans: (explanation 2 marks, diagram 2 marks)

Diagram:



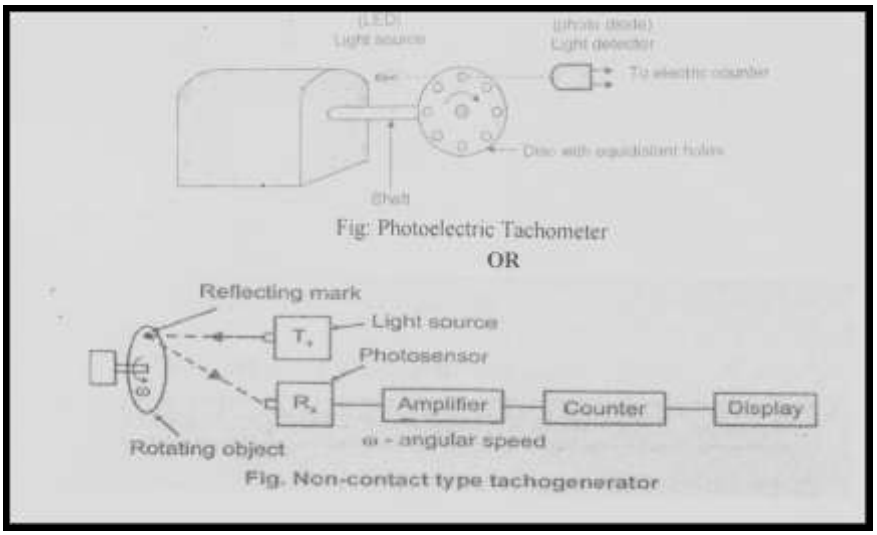
Explantion:

- A generalized block diagram of a basic successive approximation converter is shown in figure.
- The converter uses a digital control register with gateable binary inputs of 1 and 0, a D/A converter with a reference voltage supply, a comparison circuit, a control timing loop, and a distribution register.
- At the start of conversion cycle, both the control register and distribution register are set with a 1 in the MSB and a 0 in all bits of less significance. Thus the distribution register shows that the cycle has started and the process is in the first phase.
- The control register shows 1000, and this causes an output voltage at D/A converter section of one half of reference supply.
- At the same time, a pulse enters the time delay circuitry. By the time that the D/A converter and the comparator have settled, this delayed pulse is gated with the comparator output.
- When the next MSB is set in control register by the action of timing circuit, the MSB remains in a one state or it is reset to 0 depending upon the comparator output.
- The single 1 in the distribution register is shifted to the next position and keeps track of the comparison made.
- The procedure repeats itself following the diagram of fig until the final approximation has been corrected and the distribution register indicates the end of the conversion.

e) Draw the labeled diagram of method for measurement of speed by non-contact type transducer.

Ans: (explanation 2 marks, diagram 2 marks)

Diagram:



The light passes through the holes available on the rotating disc with a specific interval, depends on the angular speed of the disc having equidistant holes. The frequency of this light pulses is measure of the angular speed of the disc.

Working:

- This method of measuring speed of rotation consists of mounting 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 in the line of the light source, a light sensor like phototube or some photosensitive semi conducting device is placed.

f) Select the suitable transducer for following application:

i) Measurement of angular Displacement
ii) **Measurement of room temperature**
iii) **Measurement of air pressure inside the car type**

Ans: (2 marks for one transducer, 1 mark each for other two)

i) Rotary potentiometer or RVDT
ii) Thermistor or RTD
iii) Bourdon tube

Q.6. Attempt any FOUR : 16M

a) List any six criteria for selecting a proper transducer for an application
(Any six criteria for 4 marks)

Selection criteria of transducer is:-

1. Operating Principle
2. Sensitivity
3. Operating Range
4. Accuracy
5. Cross Sensitivity
6. Errors
7. Transient And Frequency Response
8. Loading Effect
9. Static Characteristic
10. Ruggedness

b) Explain the working of turbine flow meter using proper diagram.
Ans: **(diagram 2 marks, explanation 2 marks)**
Diagram:

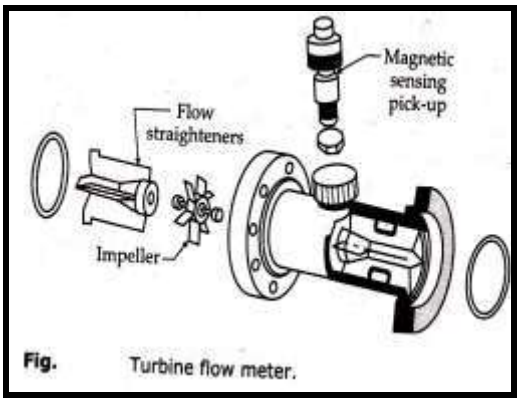


Fig. Turbine flow meter.

Explanation:

Turbine flow meter s are volumetric flow meters and are available in wide ranges. The output is usually in the form of a digital electrical signal whose frequency is directly proportional to flow rate and whose total count is proportional to flow rate and whose total quantity , as each pulse represents a discrete volume .
A feature of this turbine meter is a hydraulically supported turbine rotor. A permanent magnet sealed inside the rotor body is polarized at 900 to the axis of the rotation. As the rotor rotates so does the magnet and therefore rotating magnetic field is produced. This produces an a.c voltage pulse in the pick-up coil located external to the meter housing . The frequency of this voltage is directly proportional to the rate of flow. The pulse can be totalized by a counter to give the value of total flow over a particular interval of time**.**

c) State the concept of ratio metric conversion and logarithemic conversion in DAS.
Ans:
Concept of ratio metric conversion: **(02M)**

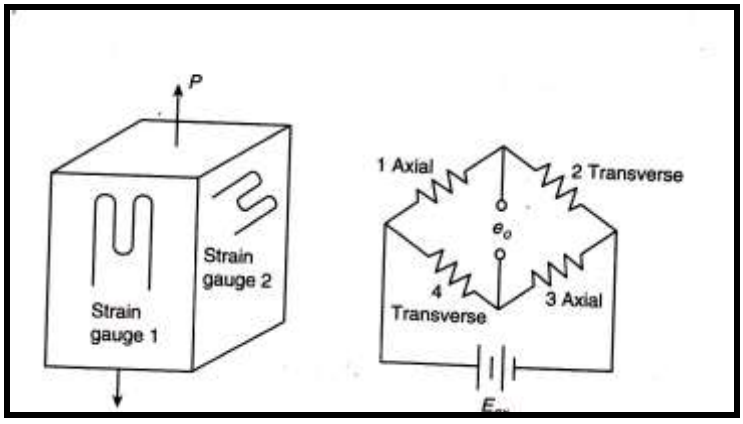
It is a signal conditioning method applicable with DAS .
It includes an analog voltage divider to which an excitation voltage is given as the input . The output of it is given to an instrumentation amplifier and then to A to D converter. The output voltage of the divider is the ratio of the amplifier output voltage and the excitation voltage. Thus by this method the output of the signal amplifier will be a voltage proportional to the input parameter only and independent of the input excitation voltage. Hence the system accuracy improves since variation in the excitation voltage does not affect the sensitive of the system.
Logarithemic conversion:
Explanation: **(02M)**

It is a signal conditioning method applicable with DAS.
The logarithmic conversion circuit enables the measurement of s fractional change in the input as a percentage of the input magnitude rather than a percentage of range. It improves the resolution

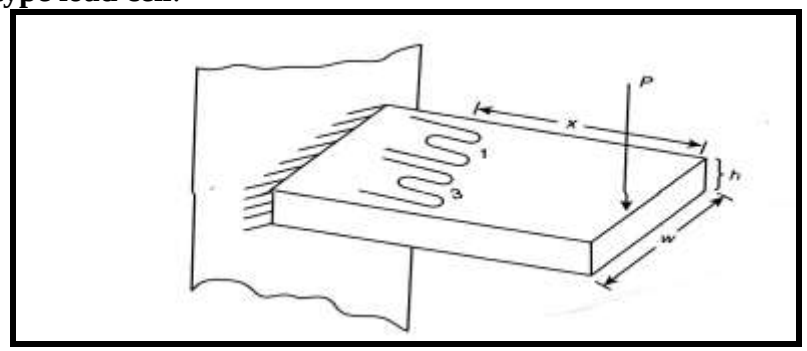
d) List the types of load cell and explain any one with neat diagram.
Ans: (list- 2 marks, diagram with short explanation 2 marks)

(NOTE: Diagram may vary but explanation remains same)

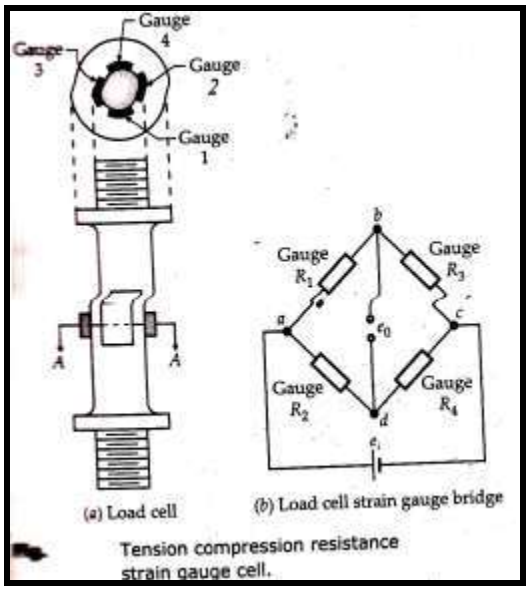
1. **Column type load cell**:



2. **Cantilever beam type load cell**:



3. **Intelligent load cell**:



Load cell uses an elastic pressure sensor as the primary transducer and strain gauge as the secondary transducer. Strain gauges are attached to an elastic structure (column or cantilever) on which the load to be measured is applied. The resultant strain produces deflection of the structure

e) Compare RTD and Thermistor.

Ans} Comparison:- any 4 [1 mark each]

RTD	**Thermistor.**
• .RTD is made up of metals. • Metals have Positive Temperature Coefficient (PTC) of resistance. Hence,the resistance of RTD increases with an increase in temperature and decreases with a decrease in temperature. • The resistance temperature characteristics of RTD's are linear. • It is less sensitive to temperature compared to thermistor. • But, it has-a wide operating temperature range i.e., minus 200 to plus 650°C. • RTD's are relatively larger in size. • They are costlier as compared to thermistor.	• Thermistor is made up of semiconductor Materials • Semiconductor materials have Negative Temperature Coefficient (NTC) of resistance. • Hence, the resistance of a thermistor decreases with an increase in temperature and increases with a decrease in temperature. • The resistance temperature characteristics of thermistor are highly nonlinear. • It has large temperature coefficient

• They have low self-resistance. • RTD's provide high degree of accuracy and long term stability. • They are used in laboratory and industrial applications.	of resistance i.e. thermistor highly sensitive to temperature compared to RTD. • It has low operating temperature range compared to RTD i.e., minus 100 to plus 300°C. • Size of thermistors are small . • They are not costlier as compared to RTD. • They have high self-resistance. Thus, they require shielding cables to minimize interference problems.

f) Explain pressure measurement using diaphragm with neat diagram.
Ans: (diagram 2 marks, explanation 2 marks)
Diagram:

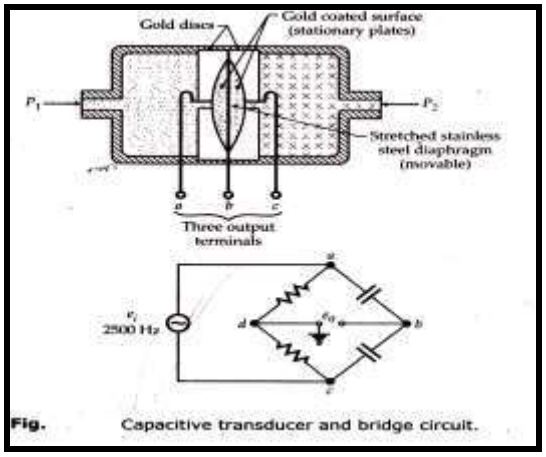


Fig. Capacitive transducer and bridge circuit.

Explant ion:
Capacitive transducers are used for the measurement of pressure by converting the pressure into a displacement. The displacement is sensed by a capacitive transducer using a differential arrangement's thin stainless steel diaphragm is clamped between the disc, acts as the moveable plate. . With equal pressures applied (*i.e.,* P1=P2) the diaphragm is in neutral position and the bridge is balanced. The output voltage e0, is zero under the conditions. If one pressure is made greater than the other, the diaphragm deflects in proportion to the differential pressure, giving an output voltage , e0 from the bridge terminal . This output voltage is proportional to the differential pressure. For an opposite pressure difference, the output voltage shows a 1800 phase shift.
This voltage may be amplified by an emitter follower amplifier.