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- Explanation
- Derivation
- Example
- Shortcuts
- Previous Years Question With Solution

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# MECHATRONICS

Sensors & Actuators

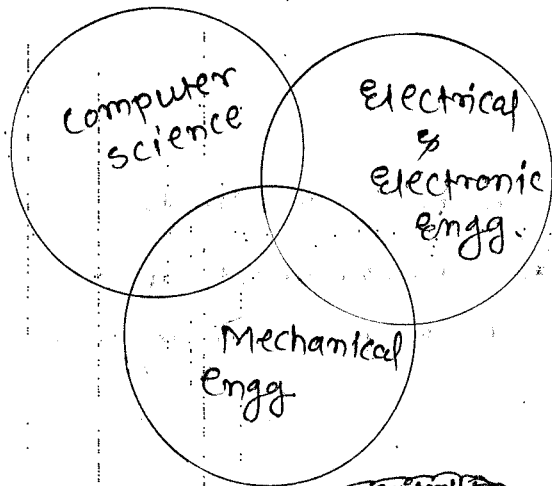
Programmable Logical devices

Control Engineering

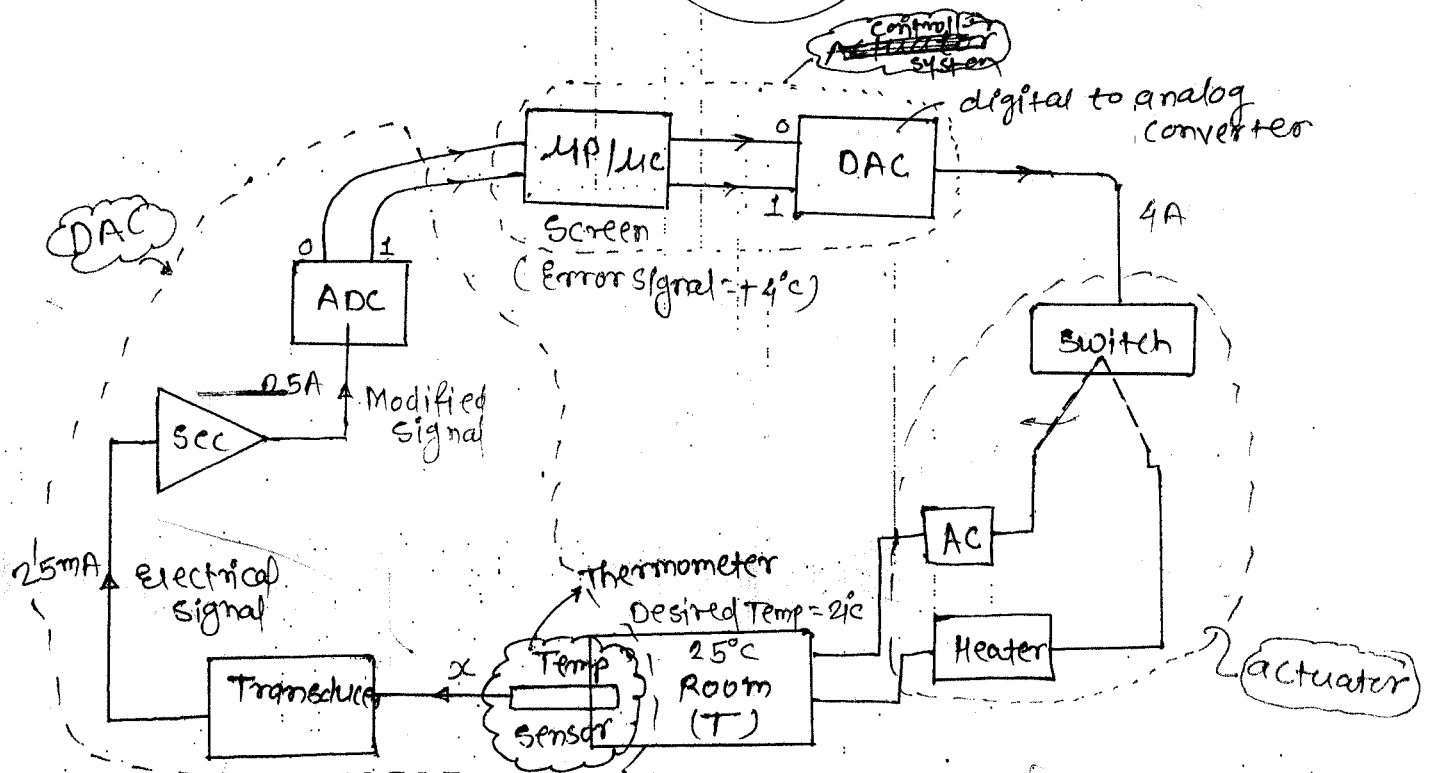
µp 8085    µc 8051    PLC

Sensors > Actuators > µp & µc > PLC > control engg.

## Sequence of question/weightage

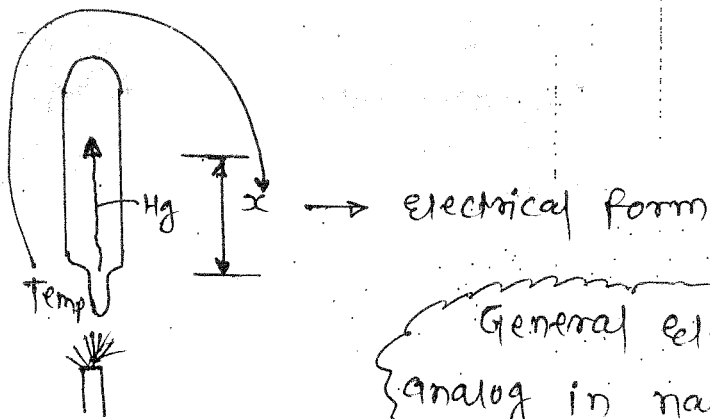


\* Smart AC :-



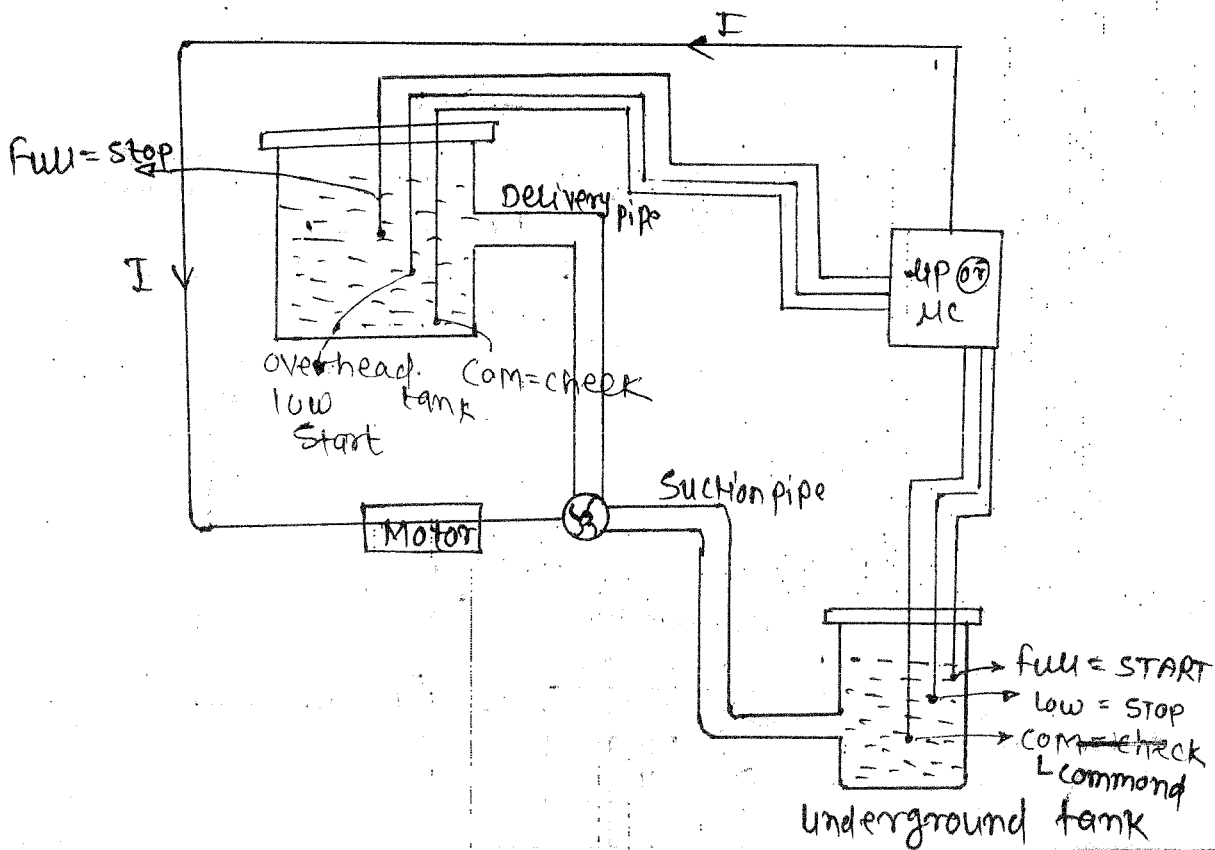
\* SENSOR (Thermometer) :-

9983322722

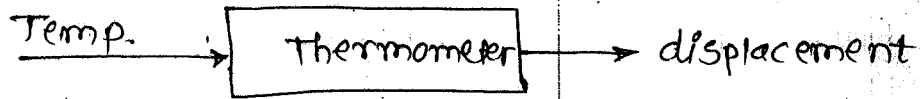


General electrical signal are analog in nature.

\* Integration of electrical and electronic devices with the mechanical system lead to the development of ~~mechanical~~ mechatronics eng.  
 e.g. - overhead tank water filling mechanism.



\* SENSOR:- It is a device which is used to sense physical quantities.



A sensor is a device which is used to convert physical quantities into measurable quantity.

Physical quantity	derived quantities	Passive electrical quantities	Active electrical quantities	Digitel output.
Temp. Pressure, force. humidity Vibration Sound light etc	$x$ $\dot{x}$ $\ddot{x}$	R/L/C	V/I/P Voltage current power	O/I.

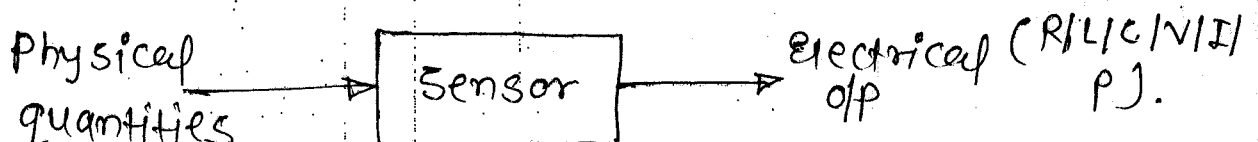
Main aim is to convert physical quantities into V/I/P.

A sensor is a device / an element which is used to produce signal relating to the quantity to be measured.

(or)

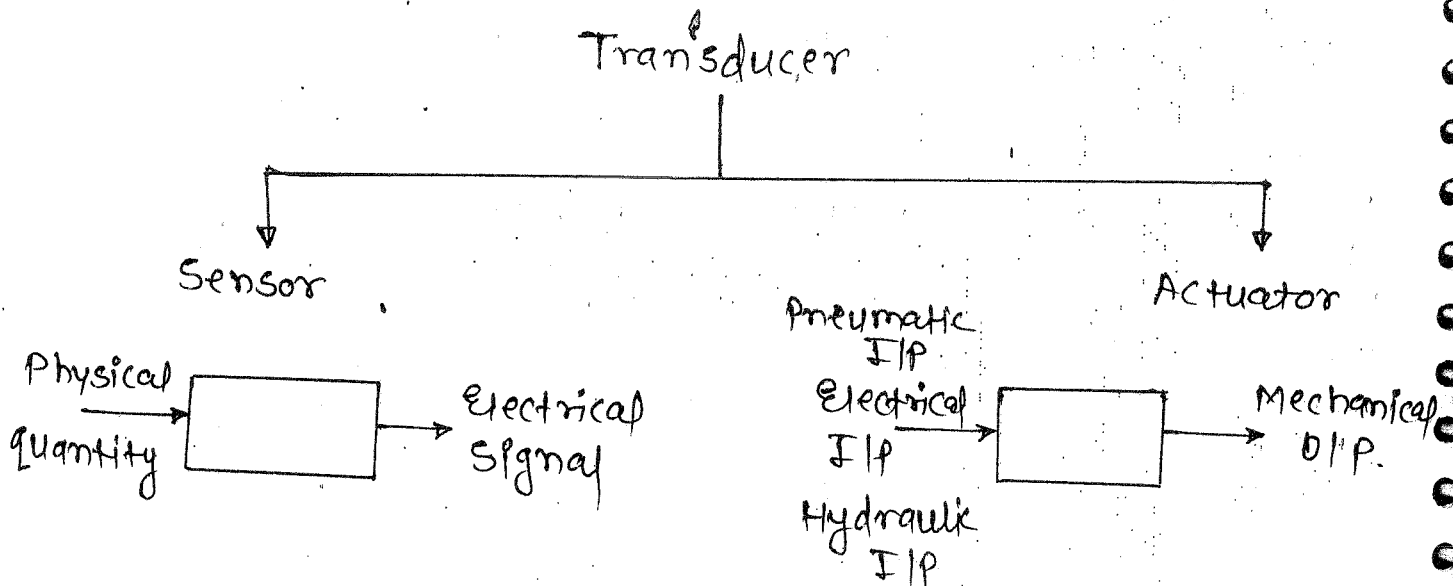
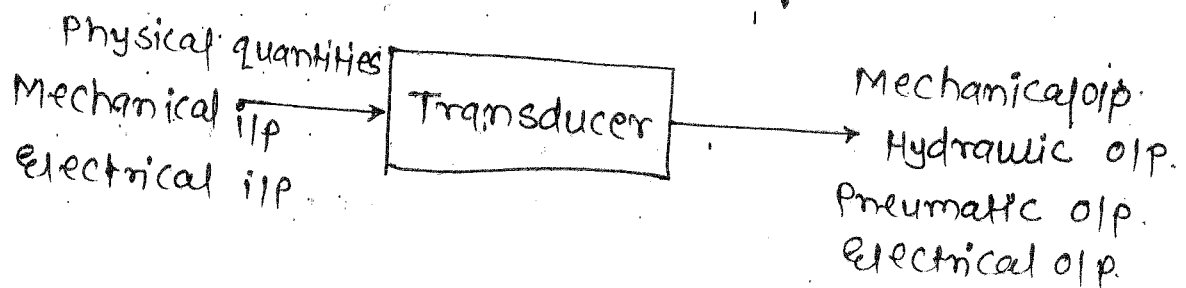
It is a device which produces o/p (usable) in response to a specific measurand.

Mechatronics:-



## Transducer :-

It is a device which one form of energy into another form.

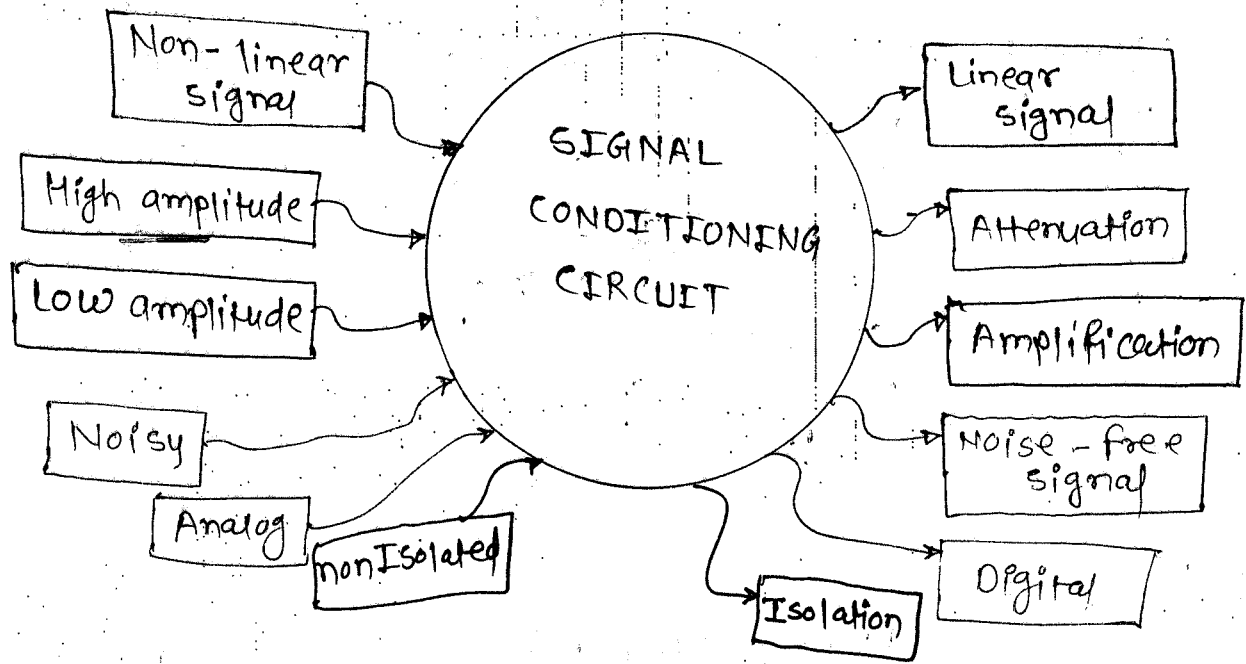
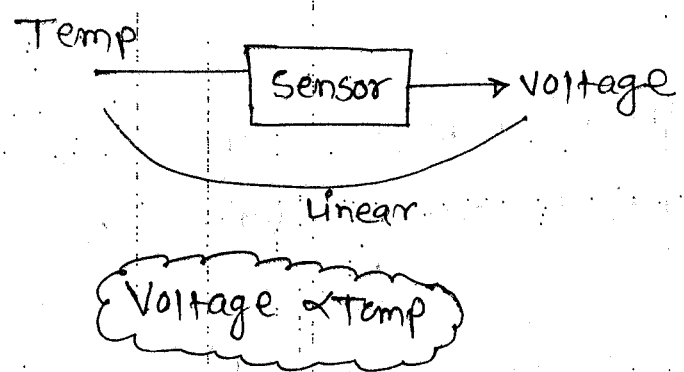


A transducer is a relative term which is used to convert one form of energy into another form.

→ An actuator is a device which is used to generate mechanical O/P from a given input (generally electrical I/P).

problem with signal produced by sensor :-

- Very weak signal
- Very strong signal
- noisy signal
- non-linear signal
- multiple signals.



The signals generally delivered by sensors are not appropriate for further use, a S.C.C is used to convert the sensor's signal into most appropriate form.

### 1) Amplifier:-

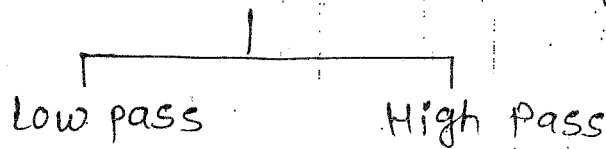
It is an electronic element which is used to enhance or amplify the input signal.

### 2) Attenuation:-

It is an ~~an~~ electronic device which is used to reduce the amplitude of i/p signal.

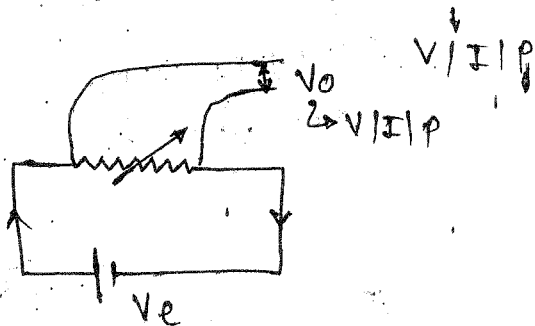
### 3) Filtering:-

It is a process of removing/rejecting signals outside our pre-defined range.



### 4) Excitation:-

Some circuits have/sensors have passive element as an o/p so an external excitation is required to generate desired o/p.



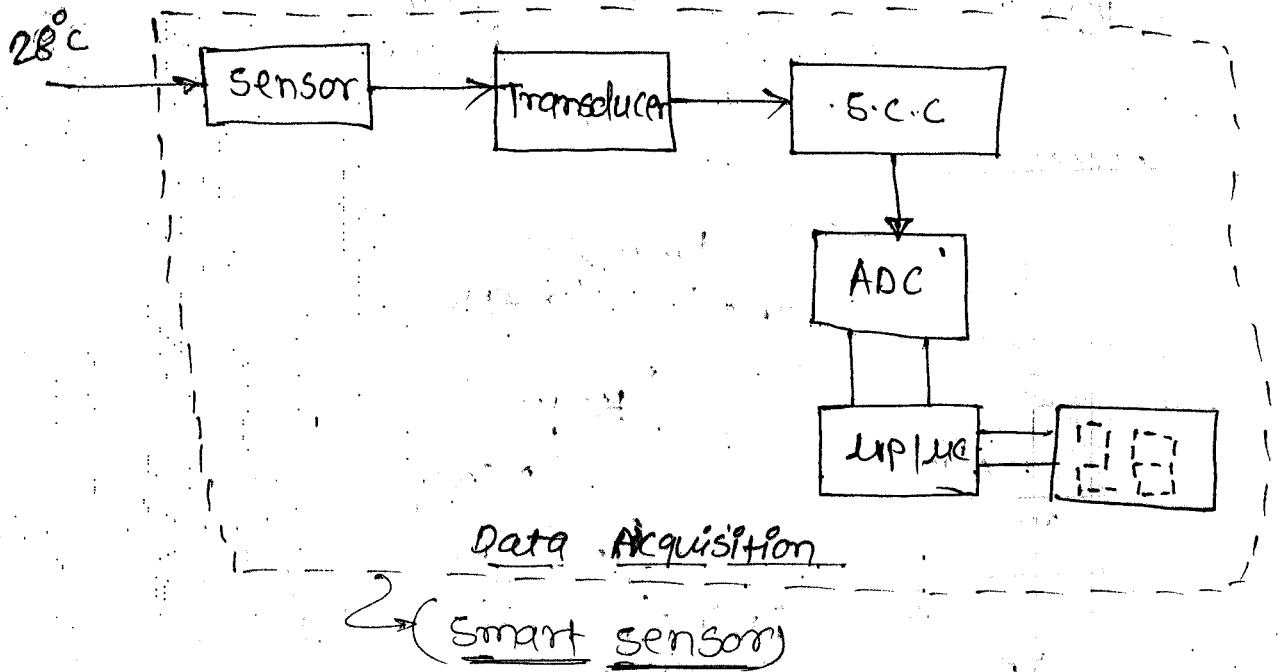
### 5) Linearization:-

It is needed when the signal produced by sensor doesn't have a linear relation with input.

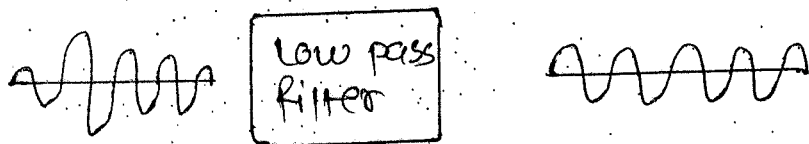
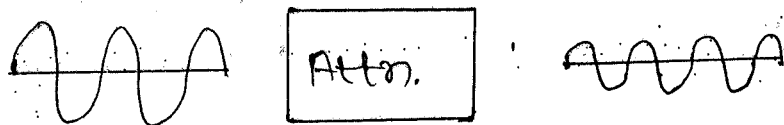
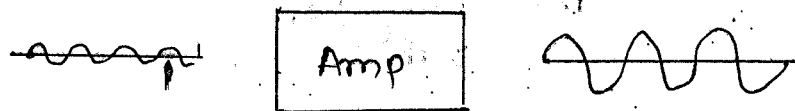


\* Signal processing circuit :-

It converts the o/p / manipulated / conditioned signal of s.c.c into more appropriate form such that end user can understand the information.



SCADA ⇒ Supervisory control and Data Acquisition.



Data Acquisition systems are the group of process that are used to measure real world physical quantities (or) conditions & converting them into digital numerical values which can be manipulated by controllers &

Q.1 (b)

Voltage  $\rightarrow (V)$

Sensitivity

$$E = 38.740 + 3.3 \times 10^{-2} \theta^2 + 2.07 \times 10^{-4} \theta^3 - 2.2 \times 10^{-6} \theta^4$$

$$S = \frac{dE}{d\theta} = \frac{38.74 \times 100 + 3.3 \times 10^{-2} \times 100 \times 100 + 2.07 \times 10^{-4} \times 100 \times 100 \times 100 - 2.2 \times 10^{-6} \times 100 \times 100 \times 100 \times 100}{100}$$

$$= 38.74 + 3.3 + 2.07 - 2.2$$

$$= \underline{41.91}$$

Q. An ammeter requires a change of 3A in its coil for produce a change in deflection of pointer by 12mm. What's static sensitivity?

displacement / Sensitivity

I/P  $\rightarrow$  3A

O/P  $\rightarrow$  Reading - 12mm

$$S = \frac{12 \text{ mm}}{3 \text{ A}} = 4 \text{ mm/A}$$

\* RESOLUTION :-

$\rightarrow$  Least count of a sensor.

