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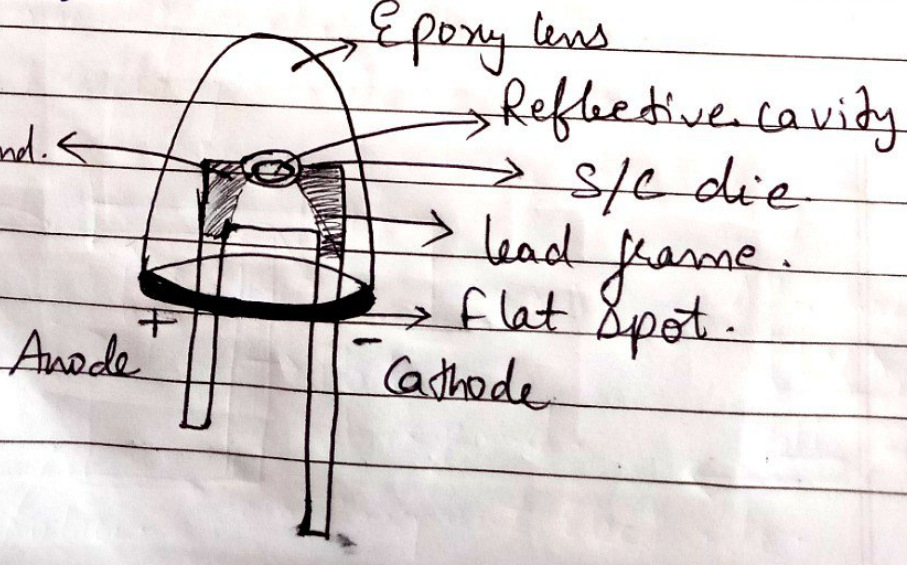
Unit - IV

☆) Digital Display Devices :-

Recently, there are so many digital devices, which everywhere utilized by System.
Ex:- LED, TV screen, LCD TV screen, smartphones, CRO (cathode Ray oscilloscope) and many other gadgets utilised by aeronautics & medical department.

1) Light Emitting Diode (LED) :-

The LED is a semiconductor device that emits the light when current flows through it. The electrons in the semiconductor recombines with holes that releasing the energy in the form of photons. The colour of light that depends upon the energy and wavelength of photons of that light. This energy required for electrons to cross the band gap of the semiconductor. When light obtained white in colour by using multiple semiconductor layers of light emitting phosphour on the semiconductor device.



These are parts of conventional LED device. The flat bottom surfaces of the lead frame, embedded inside the epoxy which acts as an anchor to prevent the conductor from being forcefully pulled out via mechanical strain or vibration.

2.) Liquid Crystal Display/Diode (LCD) :—

Liquid Crystal diode/display (LCD) is defined as the diode that uses small cells of the ionised gases for the production of images. The LCD works on the modulating property of light, that is the technique of sending & receiving the signal of lights. The liquid crystal consumes small amount of energy because they are reflector and transmitter of light. It is normally used for seven segment display.

The liquid crystals are the organic compound which is in the form of liquid in spite of that have property of optical crystals. The layer of liquid crystal is deposited on the inner surface of glass electrodes for the scattering of light. The liquid crystal cell is of ~~two~~ two type :—

1.) Transmitting Type / Transmittive Type
2.) Reflective Type

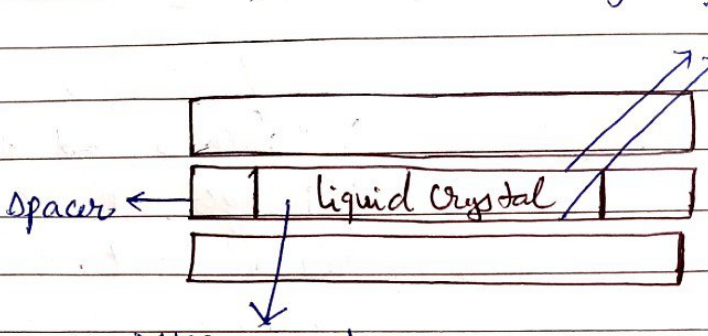
1.) Transmitting Type.

In this type of cell, both the glass sheaths are transparent in nature. So, that the light is scattered in the forward direc^n

, when the cell become active.

2.) Reflective Type.

The Reflective type cell consist of reflecting surfaces of the glass sheat on one end whereas incident on the front ~~cells~~ surface of the cells, is scattered by the activated cells.



Ex:- The organic material comp^d in liquid crystal form are:- PMMEA (poly methyl metha-airylate), pentacene, tetracene and so on.

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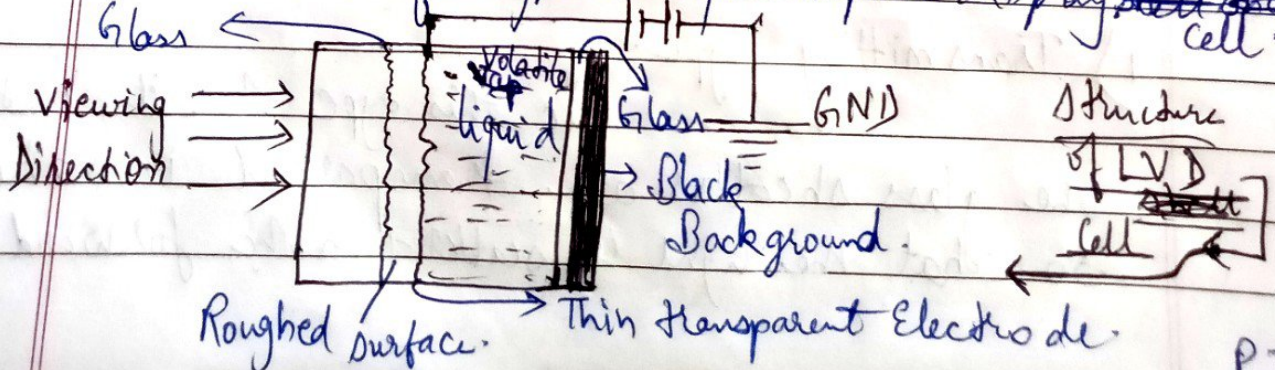
3.) Liquid Vapour Display :-

(LVD) are the latest economical display technology. They employ a new reflective passive display principle and depend on the presence of ambient light for their operation. The figure gives the structure of a typical liquid vapour display cell.



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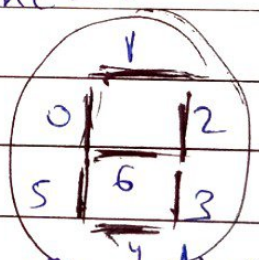
Assignment - IV

Q.) Write down :) Seven-Segment display
:) Fourteen Segment display.
:) Data Acquisition & Conversion.
:) Single & Multi channel DAS.
:) A to D & D to A conversions by using O-Amp.

→ It consists of transparent ~~voltalite~~ volatile liquid, encased b/w two glass plates and side ~~spacers~~ spacers. The ~~Rare~~ rear glass plates ~~and~~ has black back ground & the front glass plate in contact with the liquid is roughed surface. So that the liquid wets i.e in its simplest form and LVD consist of a roughed glass surface wetted with transparent volatile liquid, which have same refractive index as the glass.

The transparent electrode is heated by using a voltage drive which is the basis of display func^{n}.

Note :- 1.) Seven Segment Display.



A seven segment Display is an electronic display device which is used to display numerical characters from 0 to 9 or some special characters. There are seven LED's present in one unit of the seven segment ~~display~~ whose combination is used to make numeral or special characters according to the use. One or more such units are

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Combine to display bigger numbers. This kind of display is generally used in digital clocks, calculators, wrist watches & many more electronic devices that display numerical information. It consist of 7 segments ~~Construction: There are seven small Rectangular LEDS are present in a seven segment display.~~ of LED (LEDs) which are assembled like numerical 8.

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(DAS)

*.) Data Acquisadion System :-

→ The system used for data Acquisadions are such as conversion of data, storage of data, transition of data, processing & transmission of data are known as Data Acquisadion System.

It is considered two types of Data Acquisadion System :-
1.) Analog D.A.S
2.) Digital D.A.S

1.) Analog D.A.S :- The analog signals which are obtained from the direct measurement of electrical quantities such as DC and AC voltage, DC & AC current, Resistance and power etc. The analog signals also obtained from transducer such as LVDT, resistance thermometer, etc. These analog signals which convert physical quantities into electrical quantities are known as analog transducers. It performs the functn like amplification and selection of desired portion of the signal. It also works as a display device, graphical recording instrument, magnetic tape instrument, etc.

2.) Digital DAS :- The Digital D.AS can be operated with digital signal where digital components are used for storing & displaying the information.

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4.) The operation Performance of in Digital (D to Analog also A to D conversion) DAS

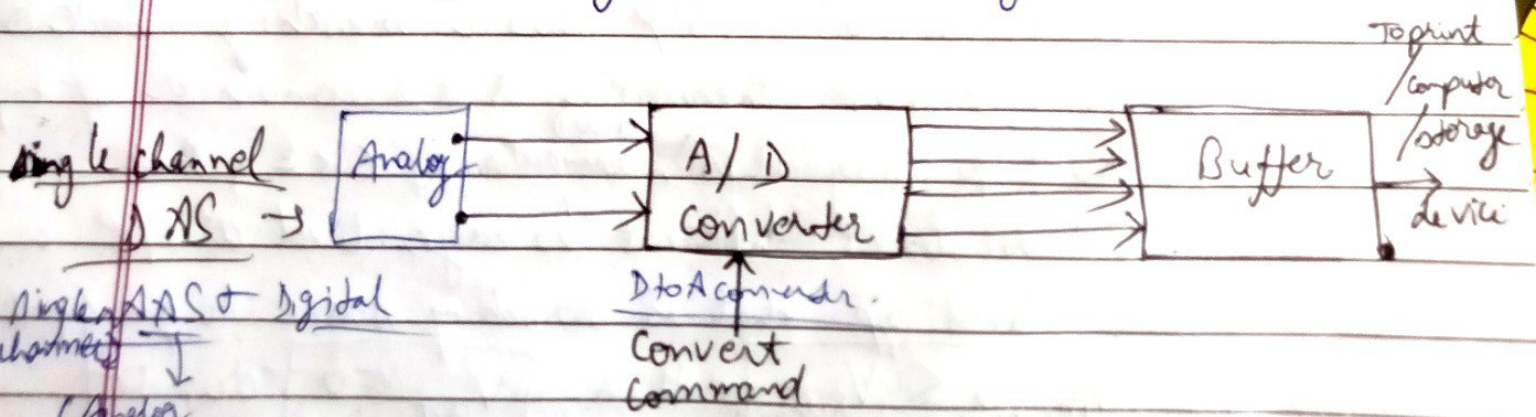
1.) Acquisation of Analog & digital Signals.
2.) The conversion of Analog to digital or digital to Analog signals
3.) Processing of digital signals / analog Signal.

→ The following Blocks are required for Digital DAS

1.) Transducers
2.) Signal condition
3.) Multiplexer.
4.) Analog to Digital converter, 5) diplay device, 6) digital recorder

5.) Single channel & Multi channel DAS

The Block diagram of single channel DAS shown in the figure & it consists of signal condition, A to D converter where the o/p of single conditioner is given to the A to D converter. The rate of conversion is internally to determine. The digital o/p from the buffer are fit to a storage system or plinter or computer system for further analysis.



Single channel DAS & Digital (Analog Regulsation Systems)

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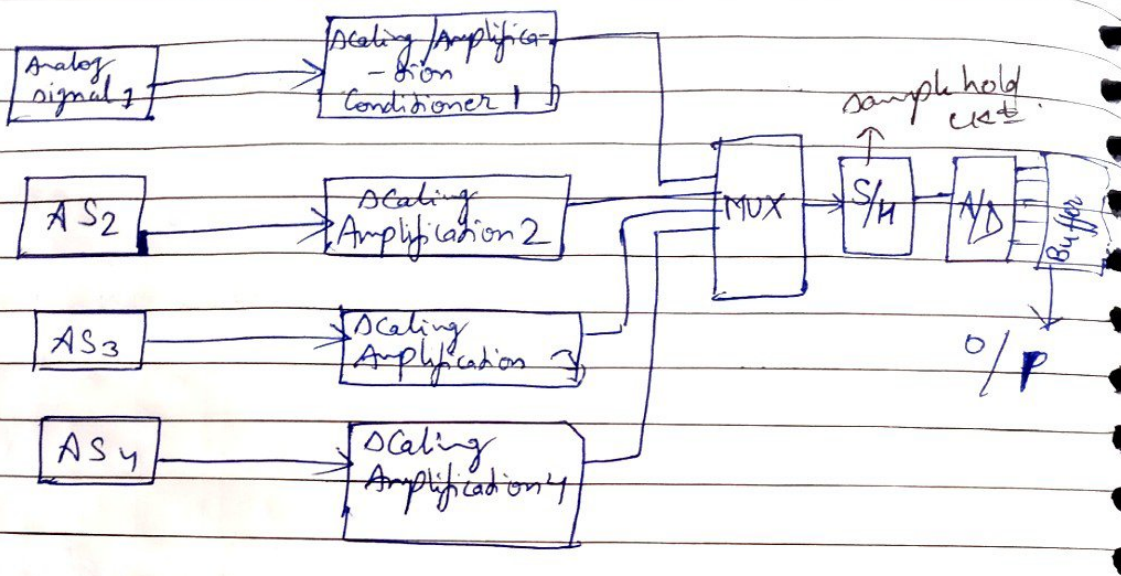
☆) Multichannel DAS :-

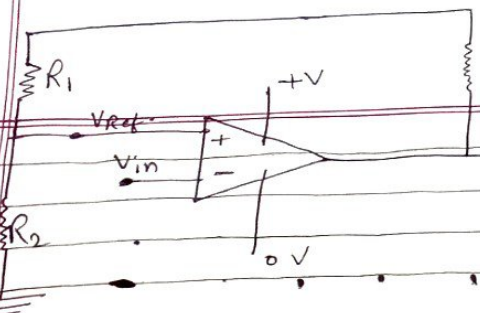


☆) A to D & D to A Converter by using Op-Amp
(Analog to Digital)

·) A to D Converter by using Op-Amp

The process of taking an analog voltage signal and converting it into an equivalent digital signal can be done in many different ways. One simple and easy way is being by using parallel encoding also known as flash, simultaneous or multiple comparator converter in which comparator are used to detect different voltage levels and o/p their switching state to an encoder. Therefore, A to D converter op-Amp is ~~not~~ nothing it's a comparator ckt, that are used to detect different voltage level at i/p and their related o/p that is switching state to an encoder.

→ If $V_{in.} < V_{ref.}$ then, $V_{out} = 0$ or, 'off' condition.

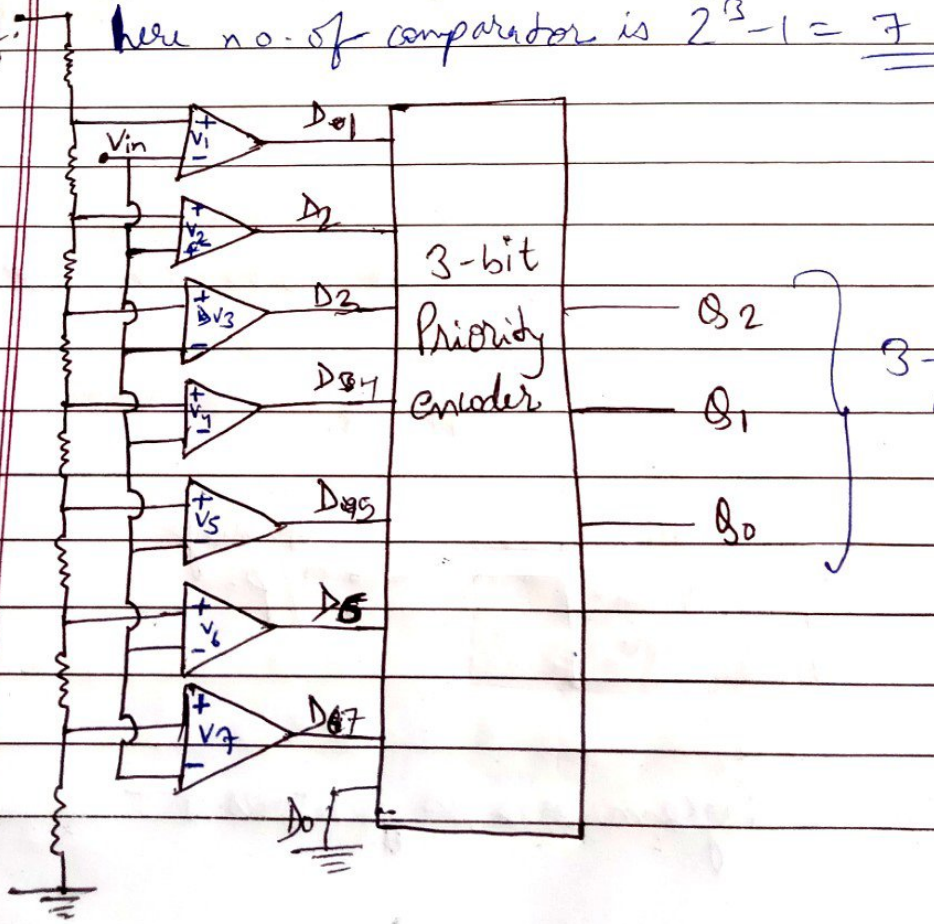


A/D comparator CKt

→ If $V_{in} > V_{ref.}$ then, V_{out} is in 'ON' state condition

Thus, comparator compare two voltage level at i/p side and determine which one of the two is on higher state. In general, $(2^n - 1)$ comparators would be required for conversion of n bit binary o/p. For ex for 3-bit analog to digital converter, the no. of comparator is 7 ($2^3 - 1 = 8 - 1 = 7$).

For 3-bit A to D converter as shown in the fig., here no. of comparator is $2^3 - 1 = 7$.

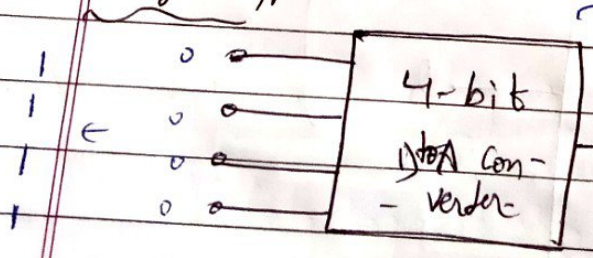


Truth Table of 3 bit A to D converter O/P will Comparator O/P.

Analog I/p (V_{in}) (Voltage)	Comparator O/P D_7	D_6	D_5	D_4	D_3	D_2	D_1	D_0	Digital O/P Q_2	Q_1	Q_0
Ref. → 0 to 0.5V	0	0	0	0	0	0	0	0	0	0	0
0.5 to 1V	0	0	0	0	0	0	1	X	0	0	1
1 to 1.5V	0	0	0	0	0	1	X	X	0	1	0
1.5 to 2V	0	0	0	0	1	X	X	X	0	1	1
2 to 2.5V	0	0	0	1	X	X	X	X	1	0	0
2.5 to 3V	0	0	1	X	X	X	X	X	1	0	1
3 to 3.5V	0	1	X	X	X	X	X	X	1	1	0
3.5 to 4V	1	X	X	X	X	X	X	X	1	1	1

☆) Digital to Analog Comparator by using Op-Amp: in the form of conversion.

The D to A converter transforms digital signal into analog signal. A typical example of 4-bit D to A converter can be Realised in many ways. The ckt diagram of 4-bit D to A converter by using Op-Amp are as shown below :-



The ckt diagram are as follows :-

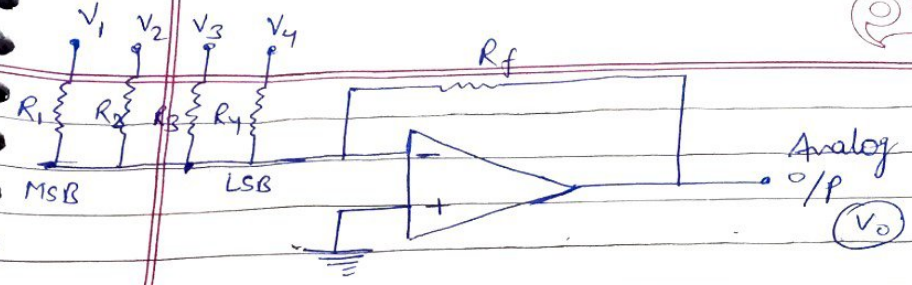


fig → binary weighted ladder
or
D/A convertor by using op-Amp.

The ~~bits are digital~~ digital bits in the form of V_1, V_2, V_3 & V_4 are weighted according to magnitude of their place value by descending value of $\frac{R_f}{R_n}$ where $n = 1, 2, 3, 4$.

So that each lesser bit has half the weight of the next higher value. The ckt diagram shows an inverting summing amplifier where the o/p is related to i/p.

The o/p voltage $V_o = -\left[\frac{R_f}{R_1}V_1 + \frac{R_f}{R_2}V_2 + \frac{R_f}{R_3}V_3 + \frac{R_f}{R_4}V_4\right]$.

Ex:

Let these 4 values of resistances are equal that is

$R_1 = R_2 = R_3 = R_4 = R_f$

$$\therefore V_o = -\left[\frac{R_f}{R_1}V_1 + \frac{R_f}{R_2}V_2 + \frac{R_f}{R_3}V_3 + \frac{R_f}{R_4}V_4\right]$$

$$\Rightarrow V_o = -[V_1 + V_2 + V_3 + V_4]$$

using this equⁿ, for a digital data i/p V_1, V_2, V_3, V_4, we will get an analog data o/p V_0.

The truth table for D to A converter is :-

Binary I/p				Decimal value	V_{out} ($-V_0$).
V_4	V_3	V_2	V_1		
0	0	0	0	0	0
0	0	0	1	1	-1
0	0	1	0	2	-1
0	0	1	1	3	-2
0	1	0	0	4	-1
0	1	0	1	5	-2
0	1	1	0	6	-2
0	1	1	1	7	-3
1	0	0	0	8	-1
1	0	0	1	9	-2
1	0	1	0	10	-2
1	0	1	1	11	-3
1	1	0	0	12	-2
1	1	0	1	13	-3
1	1	1	0	14	-3
1	1	1	1	15	-4.

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Digital Data logger :-

A data loggers are electronic devices which automatically monitor & record environmental parameters over time, that also ~~allows~~

allowing cond^{n} to be measured, documented, analyzed ad validated. The data logger contains a sensor to receive the information d a computer chip to store it. It monitor following parameters like:-
* temperature, pressure, humidity, Carbon dioxide, ppm (parts per million), CO, N_2, O_2, etc.

The data logging can be done manually by constant human observation.

✱.) Temperature transducer :-

It is an device that convert thermal quantity into an electrical quantity as well as optical display devices. The temperature transducer contains a sensing element as the temperature changes the corresponding changes occur in certain properties of sensing elements. For eg:- Thermometer, in thermocouple the electrical potential difference produced due to temperature difference across the terminal so that thermocouple is a temperature transducer. The main features of temp. transducer are the i/p always be the thermal quantities that will convert into electrical quantities that are usually used for the measurement of temp. & heat.

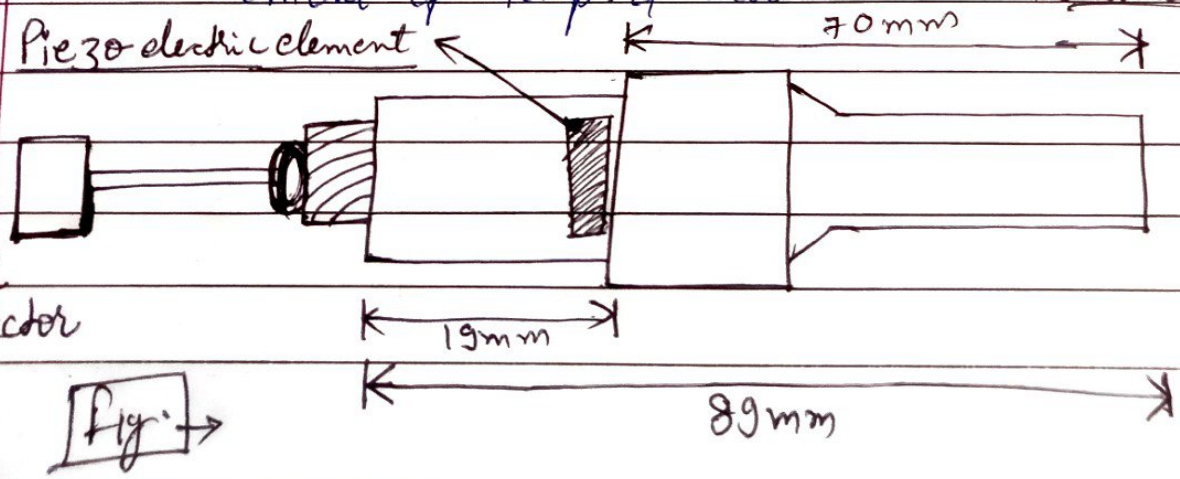

Fig:-