08/03/2022

UNIT-V

TRANSDUCERS:

* Transducer is a device which can convert energy from one form to another form.

eg: solar cell; loud speakers; LED; earphones; light etc

→ Types of Transducers:

* Electrical Transducers
* Mechanical Transducers
* Chemical Transducers
* Thermal transducers
* Active transducers
* Passive transducers
* Analog Transducers. – CRO
* Digital Transducers. — oscilloscope.

* SENSORS: detection

Photo sensors ⇒ eg: Scanners.

* All sensors are transducers but all transducers are not sensors.

10/03/2022

* Characteristics of Transducers:

1) Linearity: The input & output characteristics are linear with each other.

2) Ruggedness:

Transducer must withstand the overdose/ overload i.e. overload protection mechanism should be provided.

3) Reliability:

Transducer must be able to provide the output with min. amount of error under any environmental changes.

4) Repeatability:

Ability of Transducer to provide identical outputs for same inputs at different times.

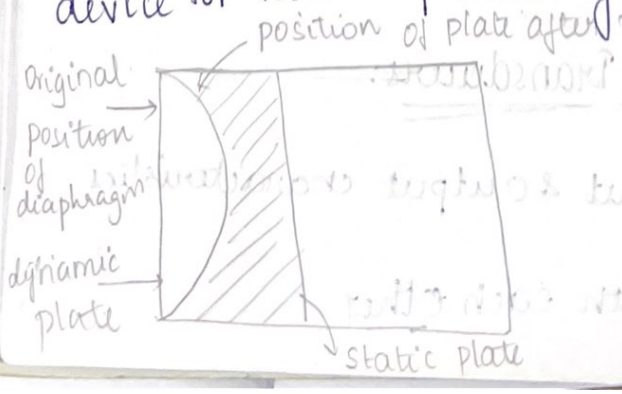
5) Good Mechanical Characteristics:

It should be independent of mechanical stress or there shouldn't be any deformity.

~~Consistent to~~

6) Compatibility:

Output must be connected with the compatible device for further processing.

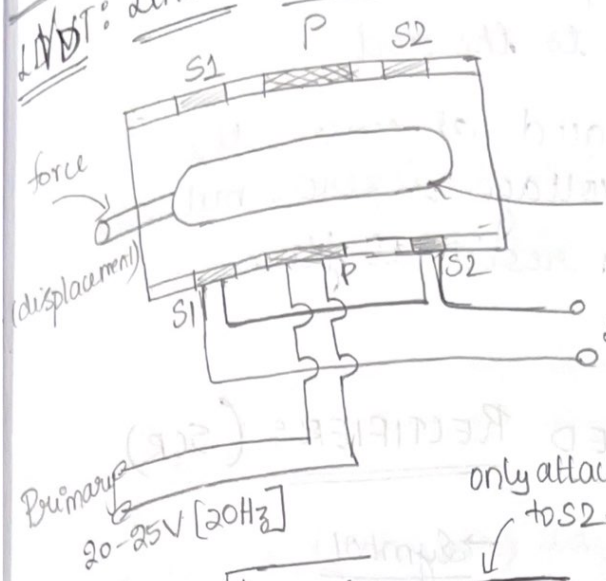


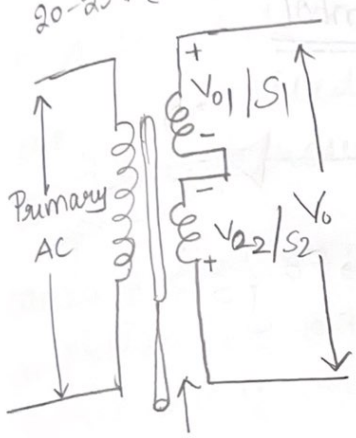
Capacitor Transducer

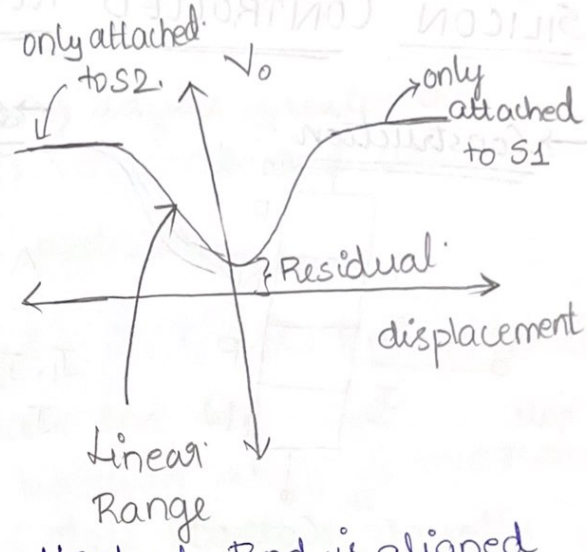
$$C = \frac{\epsilon A}{d}$$

17/03/2022.

LVDT: Linear Variable Differential Transformer:







→ When object is not attached; Rod is aligned at the centre: $V_0 = 0$: **NULL POSITION:**
Flux linkage ~~between~~ in S1 & S2 is same.

→ When the object is attached to the rod and rod is moved downwards; S1 looses contact with rod; flux will become zero across S1.
$V_{02} = max$ $V_{01} = 0$

→ When the object is attached to the rod & rod is moved ~~after~~ upwards; S2 looses contact with rod; flux will become zero across S2.
$V_{01} = max$; $V_{02} = 0$

Depending on the position of the rod or movement of the object; S1/S2/both will have a flux linked to the rod.

*When the rod is placed at centre; the expected output voltage is zero; but the inductors have a residual flux.

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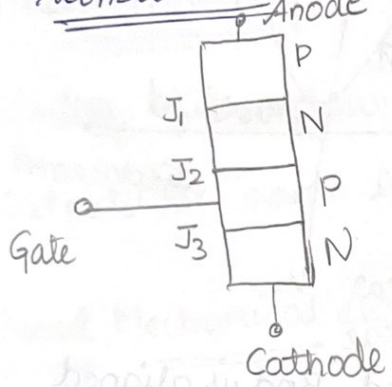
SILICON CONTROLLED RECTIFIER: (SCR)

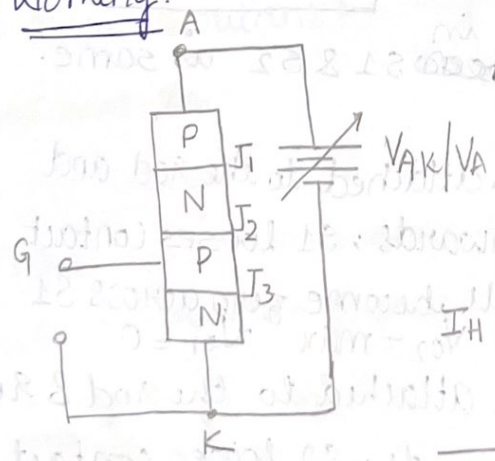
→ Construction:



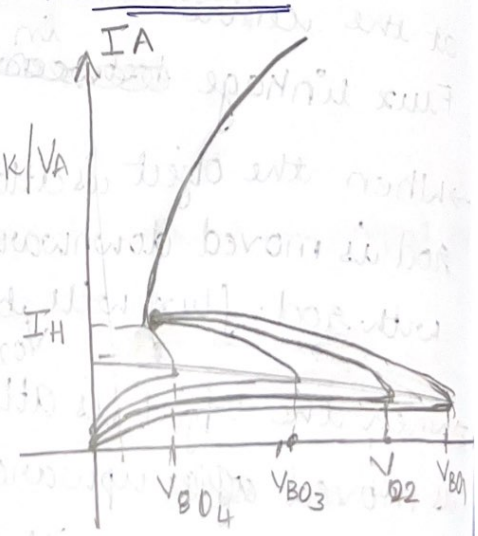
→ Symbol:

$J_1, J_3 \rightarrow FB$
$J_2 \rightarrow RB$
} SCR is in OFF state

→ Working:



→ Characteristics:



I_H = holding current

* Leakage current for silicon is very less compared to Ge
Rectifiers acting as switch requires less reverse leakage I.
* Silicon is less temperature dependent compared to Germanium.

* Output power can be controlled; if we do not want complete cycle; only a portion is required; we can use SCR.

* SCR is used for power controlled applications; lamp dimmer circuits; Motor speed controller.

* If a device is having layers greater than '3' they are called "THYRISTORS" and are used for power controlled applications.

→ When V_{AK} is supplied : J_1, J_3 are forward biased and when we increase the V_{AK} value continuously; the barrier at J_2 is overcome and SCR is in ON state; current is abruptly increased.

→ Initially SCR is in OFF state; on ↑sing V_{AK} it is in ON state.

→ The current at which SCR is in ON state; (or) the maximum current flowing is called HOLDING CURRENT.

→ The voltage applied at GATE should always be +ve so as to break the J_2 barrier earlier than before because +ve V_G makes the depletion region smaller & smaller.

* V_{AK} i.e. voltage drop is decreasing but not zero across device.
* V_{AK} i.e. outer power supply is not reducing.

→ Semi-conductors have some resistance due to the presence of minority charge carriers.

→ We can switch on the SCR using gate voltage but can't be switched OFF using gate.

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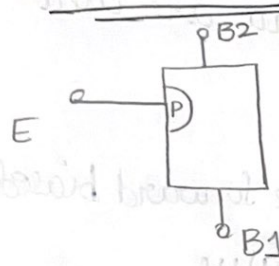
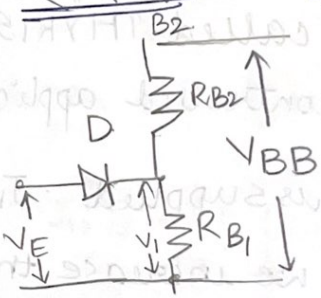
* UNI JUNCTION TRANSISTOR : [UJT]

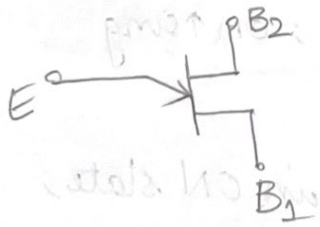
→ CONSTRUCTION:

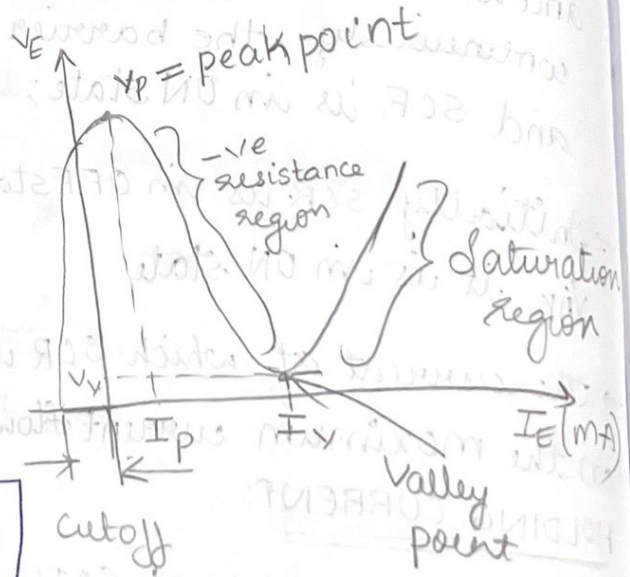


* ~~SYMBOL~~: Equivalent circuit



* SYMBOL:





$$V_1 = \frac{R_{B1}}{R_{B1} + R_{B2}} V_{BB}$$

$$V_1 = \eta V_{BB}$$

$\eta < 1$

η = Intrinsic Standoff Ratio.

* ~~Used for generating relax~~

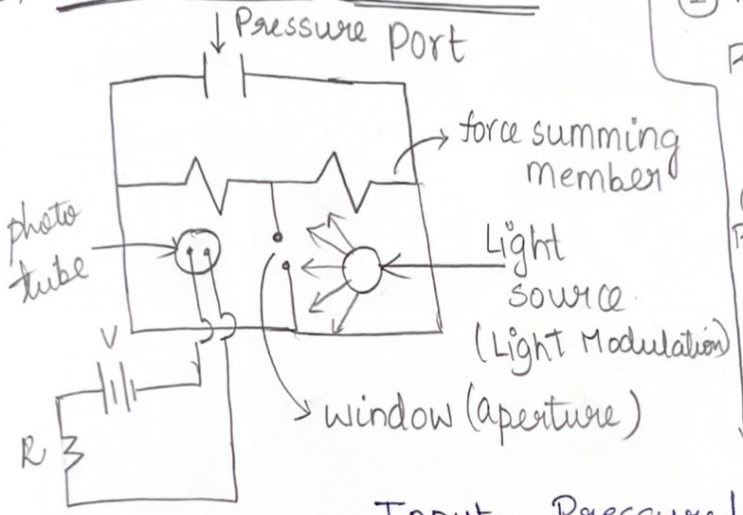
* APPLICATIONS:

* Relaxation Oscillator (Non Sinusoidal)

* Generating saw-tooth waveform.

* CRO.

⇒ Photo electric transducer:



① Thermocouple

Resistance Strain guage

② Bounded type

③ Unbounded

④ Crystal oscillator.

Input = Pressure | Force

Output = Voltage.

*