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Question 1

Describe briefly (with examples) Sensors and Actuators for Biomedical Applications.

### Application of sensor in Biomedical field

Implantable biosensor are used in Orthopedic stress and strain screening. Osteoporosis and bone tumor are two of the bone disease that can be examined with the help of biosensor.

Implantable biosensor are also used to examine ~~cardio~~ cardiovascular system. Implantable biosensor must be light weight, ~~seperated~~ separated and small.

Important application of sensor in biomedical field.

- \* Brain simulator
- \* Heart failure monitoring
- \* Blood glucose level
- \* Orthopedic disease.

In the following briefly ~~are~~ overview a sensor in ~~biomed~~ biomedical application.

### Smart Textile Biosensor

Smart material are thought to be a new product with potential in the material market. From filament till ~~techure~~ texture or even ready made dress the functionalization (main motive) of material is handled. Intricate and Imaginative Innovative approach is required for assembling a brilliant material. Joining ordinary material assembling advances ~~as~~ sewing. Sewing and weaving from the electronic circle, for example Lithography.

## Surface Plasmon Resonance

The refractive Index on the surface of a sensor can be detected using SPR. The sensor consist of a thin gold coating and using glass substrate, a beam is passed through a glass prism.

SPR is used for the detection of organic from the very small up to the very large.

## Application of Smart Actuator in Biomedical field

In various areas actuator is utilized in the field of biomedical research and application are discussed action performed by the actuator. A smart actuator in the biomedical field are based on MEMS <sup>technology</sup>. Smart actuator have multiple application in the biomedical field.

① Analysis

A ② Diagnosis

③ Drug delivery

④ Cell Culture

In the following briefly Overviews a smart actuator in biomedical application.

### Drug Delivery management using Smart micropump

The use of this system is only possible through MEMS technology. The pump can be guided wirelessly and their effectiveness, can be monitored easily.

When current is applied to electrode (platinum), water (electrolyte) splits into hydrogen and oxygen gases. This changes result in the pressure increase within the electrolyte chamber, which thus expands and drives the drug out of the reservoir. When the drug quantity decreases below the desired limit this is sensed by the level indicator, which sends a command to an external controller. This in turn refills the drugs by placing a refill needle into a refill port and transferring the drug into the reservoir.

### Microvalves for controlled direction and delivery of fluid

In the field of micro fluid system in last two decades has raised concerns with regard. With the manipulation and handling of minute sample of fluids such as heating,

transport, flow control or mixing. These advancement means the solenoid actuated micro valves are essential to current practices. These valves utilize advanced Inter digital transducer (IDTS) and a small scale reception apparatus to set up a safe remote connection to outside gadget. Power from the radio frequency bands is exchanged from there.

### Question 2

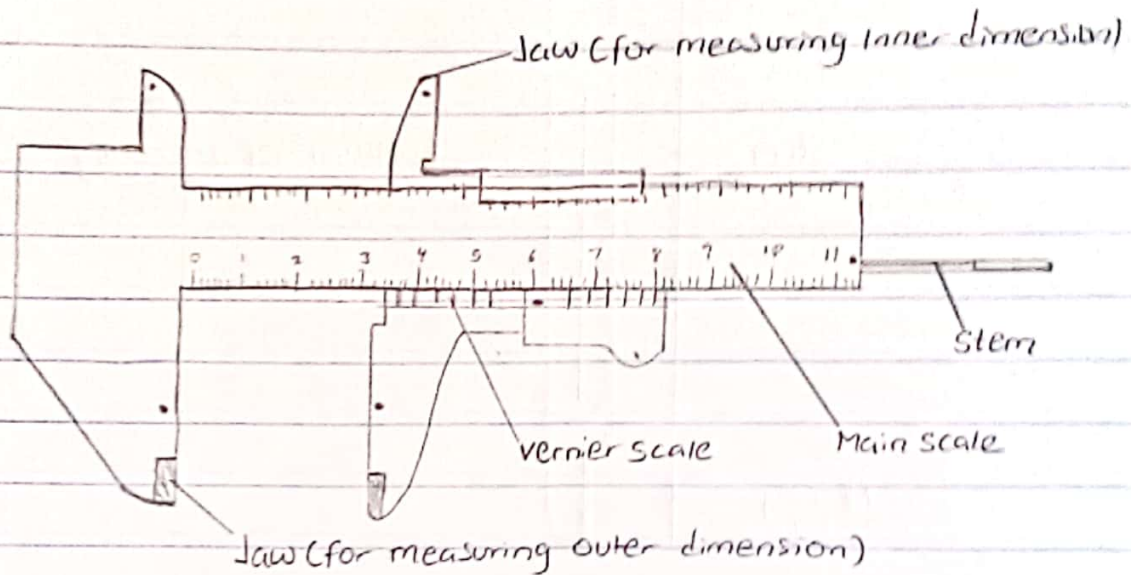
Describe with sketches and examples of the components of a basic instruments

Answer

## Question 2.

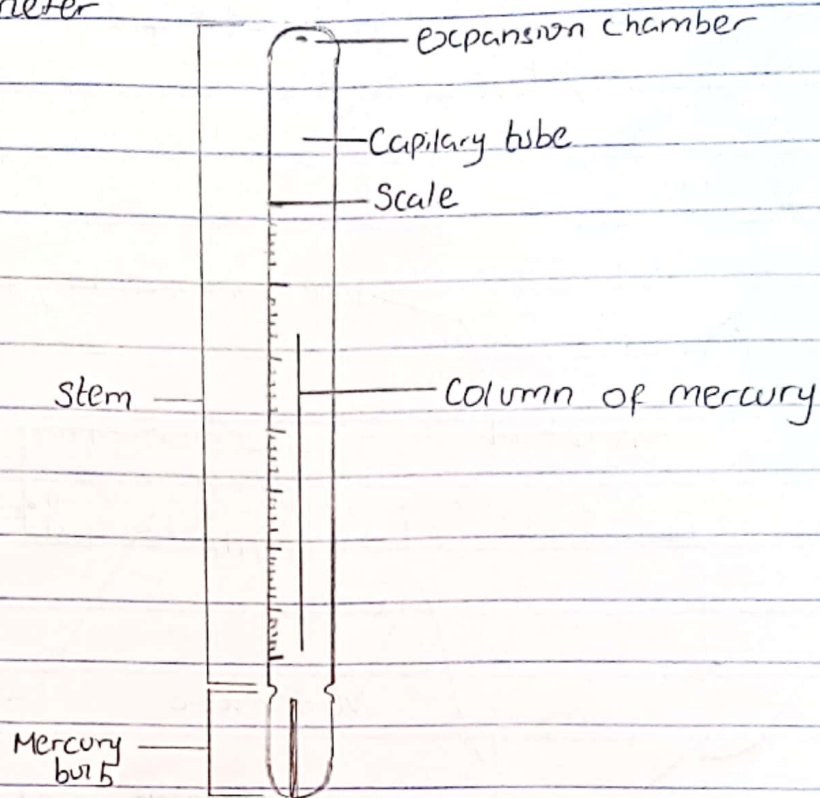
Describe with sketches and examples, of the Component of a basic measuring Instrument

### i. Vernier Caliper



- **Jaw (Inner):** The two upper jaws are the smaller jaws of the vernier that are used to measure the internal distances. Also known as upper jaw.
- **Lower Jaws:** It measures the outer dimensions of objects.
- **Main scale:** Is the large scale which runs along the body of the vernier caliper.

## 2. Thermometer



\* Mercury bulb - It acts as a reservoir to hold mercury.

\* Capillary tube - Is the tube in which mercury flows up.

\* Expansion chamber - Is to form a larger volume through which the mercury can fill the maximum temperature for scale is exceeded.

### Question 3

Describe briefly case studies of two medical measurement instruments.

(i) ~~Sphygmomanometer~~ Sphygmomanometer - Is an instrument for measuring blood pressure, typically consisting of an inflatable rubber cuff which is applied to the arm and connected to a column of mercury next to a graduated scale, enabling the determination of systolic and diastolic blood pressure by increasing and gradually releasing the pressure in the cuff.

As the heart beats, blood forced through the arteries cause a rise in pressure called systolic pressure, followed by a decrease in pressure as the heart's ventricle prepare for another beat. This low pressure is called the diastolic pressure.

The sphygmomanometer cuff is inflated to well above expected systolic pressure. As the valve is opened, cuff pressure (slowly) decreases. When the cuff's pressure equals the arterial systolic pressure, blood begins to flow past the cuff, creating blood flow turbulence and audible sounds.

(ii) Stethoscope - Is an acoustic medical device for auscultation, or listening to internal sounds of an animal or human body. It typically has a small disc shaped resonator that is placed against the skin, and one or two tubes connected to two earpieces. A stethoscope can be used to listen to sounds

- ① Thermometer : Is a device that measures temperature or a temperature gradient. A thermometer has two important elements i. a temperature sensor, in which some change occurs with a change in temperature,
- ② Some means of converting this change into a numerical value (eg the visible scale that is marked on a mercury in glass thermometer).

There is a thermometer called 'a thermometer' which is inserted into the mouth under the tongue, under the armpit and into the rectum.