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Course: BME311 Assignment

1. Sensors and actuators track different signals, operate through different means, and must work together to complete a task. They are used in separate applications and are physically located in different areas.

Sensors are used in biomedical applications to track data that comes into a machine. Biomedical sensors take biomedical variables and usually convert them into an electrical or optical signal. Examples are: Heart sound sensor, Blood flow sensor, Respiration sensor, Blood pressure sensor, Biosensors used are used in all these categories, temperature sensors, ventilators, image sensors, etc.

Actuators are used to perform actions, they take the signals and convert them into physical actions / performances; examples are thermo-responsive actuators, electromagnetic actuators, piezoelectric actuators, fluid-driven actuators (most required).

2 Components of a basic measuring instrument

i) Primary sensing element:

The quantity or the variable which is being measured makes its first contact with the primary sensing element of a measuring system. e.g is a transducer (which converts physical quantity to electrical signal / quantity).

ii) Variable conversion element: The output signal of the variable ~~conversion~~ sensing element may be any kind. Sometimes the output from the sensor is not suited to the measuring system. For the instrument to perform the desired function, it may be necessary to convert this output signal from the sensor to some other suitable form while preserving the information content of the original signal. Example we can use a Digital / Analogue converter.

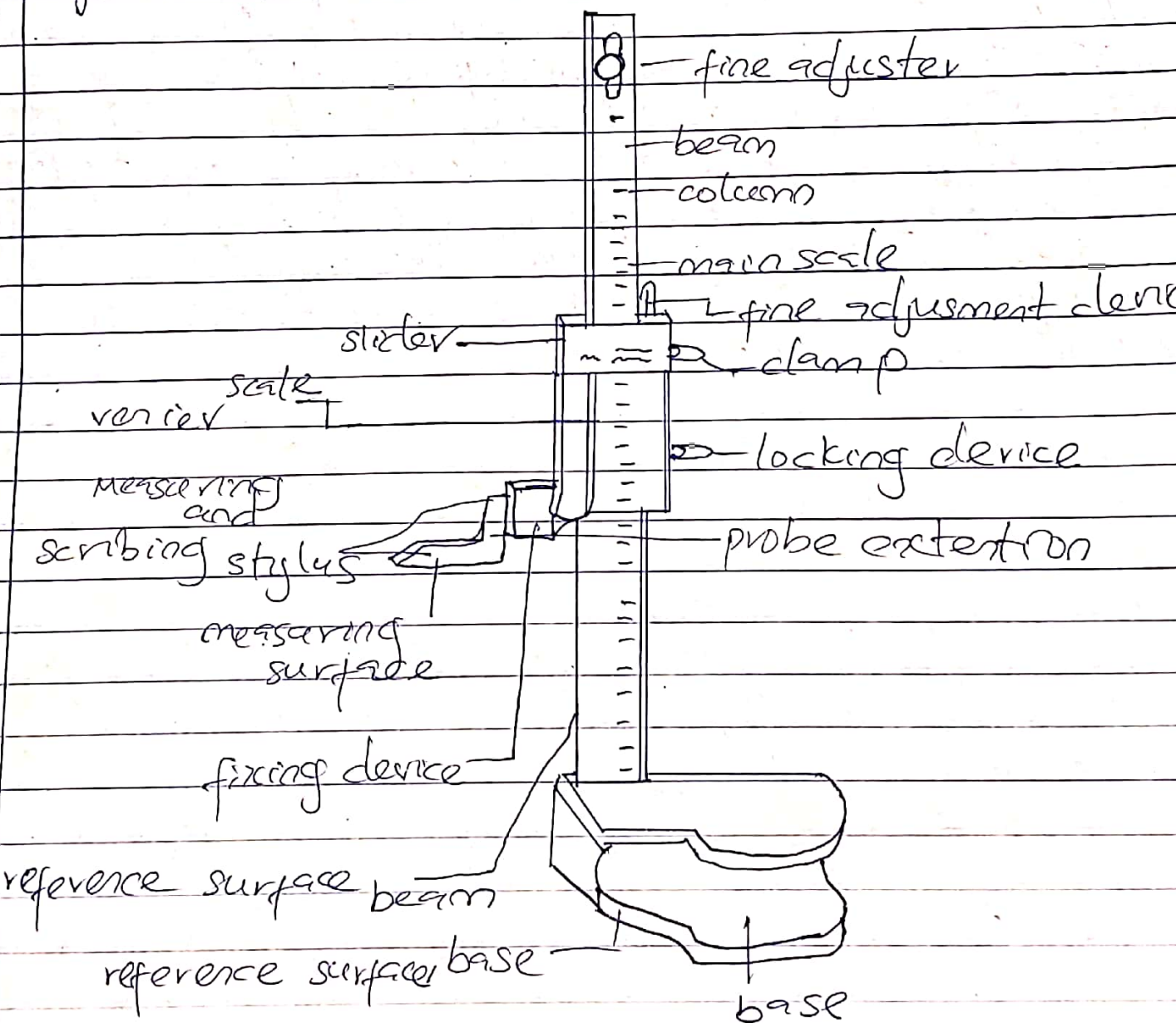
iii) Variable manipulation element: Variable manipulation means a change in numerical value of the signal. The function of a variable manipulation element is to manipulate the signal presented to this element while preserving the original nature of the signal. Example a voltage amplifier acts as a variable manipulation element.

iv) Signal conditioning element: This is the operation performed on the signal, to remove the signal contamination or distortion (interfering noise) before it is transmitted to the next stage. It could be linear like amplification, attenuation, integration, differentiation or non-linear like processes like modulation, filtering, clip clipping, e.t.c.

v) Data transmission element: This element performs the function of transmitting data from one element to another when the elements of an instrument are actually physically separated e.g. control stations used to guide satellites and air planes that are far by using radio signals by a complicated telemetry systems.

Data presentation element: This has the function to convey the information about the quantity under measurement to the personnel handling the instrument or the system for monitoring, control, or analysis purposes. The information conveyed must be in a convenient form.

Physical components: are the physical parts that make up the instrument. Example in a vernier caliper it has a beam, column, clamp, slider, vernier scale, locking device, main scale, fine adjuster, etc.



3: MM510 moisture analyser used to measure the moisture content within their medical grade oxygen. The MGS (Medical Gas Solutions Ltd) have been providing medical gases and devices to the health-care industry nationwide. They design and manufacture lightweight, high pressure valve, medical oxygen cylinders for ambulance service, etc. That is where the MM510 moisture analyser comes to measure and analyse the moisture, to detect and avoid high levels of moisture contamination.

(i) Heart rate monitor: In a case study the physical activity levels of 28 Portuguese children were assessed by heart rate monitor during their indoor physical education classes to investigate the physical activity during indoor education classes. The study showed that less than 70% of physical education class time had actually been used in classes.