LAWOYIN JONATHAN
18/ENG08/009

BIOMEDICAL ENGINEERING
BME 311 ASSIGNMENT

1. Describe briefly (with examples) sensors and Actuators for biomedical applications.

A sensor monitors environmental conditions such as fluid Levels, temperatures, vibrations or voltage. When these environmental conditions change, they send an electrical signal to the sensor, which can then send the data or an alert back to a centralized computer system or adjust the functioning of a particular piece of equipment.

Many different kinds of sensors can be used in biomedical application. According to the sensing principle in biomedical application, biomedical sensors can be classified into physical and Chemical sensors. In the case of physical sensors, quantities such as geometric, mechanical, thermal and hydraulic variables are measured. In biomedical applications these variables can include things such as muscle displacement, blood pressure, core body temperature etc The second major classification of sensing device is chemical sensors. In this case sensors are concerned with the chemical quantities such as identifying the presence of chemical composite, detecting the concentration of various chemical species and monitoring the chemical activities in the body for diagnostic and therapeutic applications.

Examples of biomedical sensors include

* oxygen and carbon dioxide sensor for blood
* Heart Sound sensor
* Blood flow sensor
* Respiration Sensor
* Blood piessure sensor

Actuator

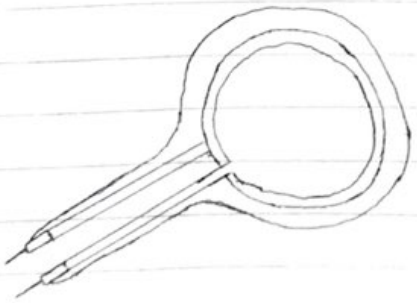
An actuator, on the other hand causes movement. It takes an electrical signal and combines it with an energy source to create physical motion. An actuator may be pneumatic, hydraulic, electrical, thermal or magnetic.

Examples of biomedical actuator include

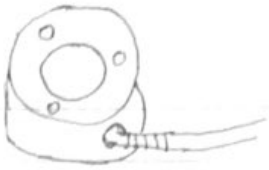
- Electric actuators
- Spring actuators
- Hydraulic actuators.

2). Describe with sketches and examples of the components of a basic measuring instrument.

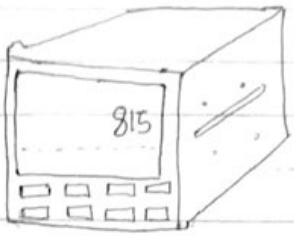
i) Force sensors :- Force sensors use load cells to weigh objects and prevent machinery from overloading. At the core of the force sensors are load cells, transducers that convert force into measurable electrical outputs. These are hydraulic, pneumatic, piezoelectric and capacitive load cells.



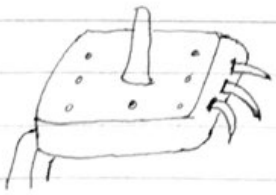
ii) Load cell A load cell is a force transducer. It converts a force such as tension, compression, pressure or torque into an electrical signal that can be measured and standardized. As the force applied to the load cell increases, the electrical signal changes proportionally.



iii) Digital indicators :- This device, connected to various sensors and transducers displays measured values digitally and output signals used for control and monitoring of the weighing system



iv) Pressure sensor - This is a device for pressure measurement of gases or liquids. A pressure sensor usually acts as a transducer, it generates a signal as a function of the pressure imposed. Pressure sensors are used for control and monitoring in thousands of everyday applications.



3) Describe briefly case studies of two medical measurement instruments.

i) <u>Weighing scale</u> :- The traditional scale consists of two plates or bowl suspended at equal distances from a fulcrum. One plate holds an object of unknown mass or weight, while known masses are added to the other plate until static equilibrium is achieved and the plates level off, which happens when the masses on the two plates are equal. The perfect scale rests at neutral

There are different types of medical weighing scales namely

* Theatre, swab and mortuary scales; used in weighing medical instruments, items required in surgery, organs etc

* Bed weighing scales; designed to be used with patients who are unable to be removed from their bed due to their current state of health.

* Flat scales; conversely, flat scales are ideal for more general uses and are similar to scales commonly found in households and other domestic areas.

* Baby scale: The weight of a newly born baby is an important measurement for midwives and doctors as it can provide an insight into possible health defects which may be present or imminent.

ii) Pipette or dropper :- To measure out doses of liquid, specially in children, often as a media dispenser. Pipettes come in several designs for various purposes with differing levels of accuracy and precision, from single piece glass pipettes to more complexe adjustable or electronic pipettes. Many pipette types work by creating a partial vacuum above the liquid-holding chamber and selectively releasing this vacuum to draw up and dispense liquid. Measurement accuracy varies greatly depending on the instrument.