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EEE 319

Measurement & Instrumentation.

1. Sensors for Biomedical Applications.

These are classified into two types:

- i. Physical
- ii. Chemical.

Physical Sensors

- i. Physical sensors are employed to measure blood pressure, body temperature, blood fluid, blood viscosity etc.

Physical sensors are divided into 4, they are the radiation sensors, mechanical sensors, thermal sensors, magnetic sensors.

- i. Radiation Sensors

They make use of radiation (X-rays or gamma rays) for imaging and treatment in a variety of biomedical applications.

ii. Thermal Sensors:

These are used to body temperature and with other instruments to indicate the persons health.

iii. Magnetic Sensors:

Magnetic Sensors are mainly based on the magnetic moment of ~~the~~ magnetic material that changes the magnetic field or temperature caused by mechanical stress.

iv. Mechanical Sensors:

These are sensors like the pressure sensor. It is triggered at a large number of physical variations. (eg force, mass)

Examples of biomedical sensors.

- i. Heart and sensors.
- ii. Respiration Sensors.
- iii. Chemical Sensors.
- iv. Optical Sensors.

8. Actuators in Biomedical Engineering.

Actuators are parts of devices or machines that help it to achieve physical movements by converting energy (either electrical, air, or hydraulic) into mechanical force.

Types of Micro-Micro-electromechanical system (MEMS) actuators:

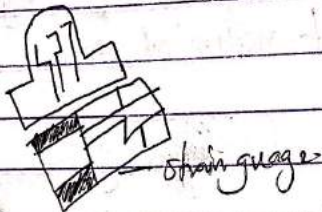
- i. Thermoresponsive actuators.
- ii. Thermo-sensitive hydrogels.
- iii. Electromagnetic Actuators.
- iv. Piezoelectric Actuators.
- v. Fluid Driven Actuators.
- vi.

Applications of Actuators in Biomedical engineering.

- i. Lab-on-a-chip (LoC).
- ii. Implantable Drug delivery systems.
- iii. Cardiac Devices.
- iv. Surgical Endoscope Tools.
- v. Laser positioning equipments.
- vi. Scanners.
- vii. MRI machines.

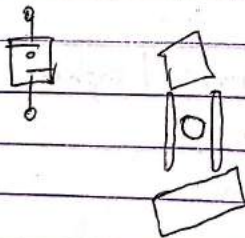
2. Measuring Components

- Strain Gauges.



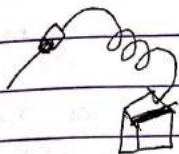
It is used to measure the strain or amount of deformation of the device when pressure is applied.

- Load Cells.



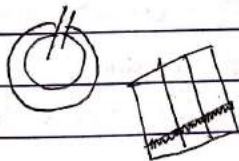
They use the strain gauge to convert tension, compression or mass into electric signals. Load cells, connected to various measuring devices for measuring purposes, display, record, control and keep trace of loads.

- Pressure Sensor -



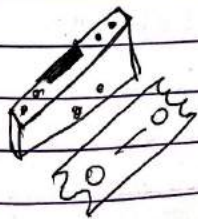
These sensors are used to measure pressure as electric signals. They display, record, control and monitor the pressure.

- Vortex Sensor.



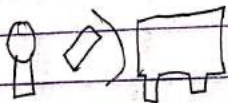
This is used to detect the direction of power.

- Force Sensors.



They are used in scales. These are used in mass production that use strain gauges.

Torque Transducers:



These sensors measure the twist with a strain gauge and transmits the output by signal or by using an optical sensors.

8. STETHOSCOPE:

This is a medical instrument or device for auscultation or listening of internal sounds of an animal or human body. It can be used to listen to sounds made by parts of the body.

Problem.

They are high level of several bacteria including *Staphylococcus aureus*... that can cause series of infections due to lack of hygiene of the stethoscope.

Mode of Operation.

Stethoscopes operate on the transmission of sound from the chest piece via air-filled hollow tubes to the listener's ears.

At the diaphragm, creating acoustic pressure waves which travel up the tubing to listener's ears.

Solution to the Problem.

Stethoscopes be disinfected with a disinfectant with a disinfectant registered with the environmental Protection Agency (EPA) unless the item is visibly contaminated with blood. They should be disinfected between each patient.

Outcome

Stethoscopes cannot be replaced and has huge usefulness. They need to be cleaned thoroughly/disinfected a desired. and as this was done risk of patients were reduced.

ii) Electrocardiograph.

An instrument used for recording the changes of electrical potential occurring during the heartbeat used especially in diagnosing abnormalities of heart conduction.

Problem

Some people experience a skin rash where electrodes were placed, but this usually goes away without treatment and people undergoing test may be at risk for heart attacks.

Mode of operation:-

Electrodes are placed on your chest to record your heart's electrical signals, which cause your heart to beat. The signals are shown as waves on an attached computer monitor or printer.

Solution to the problem

- i) Avoid greasy or oily skin creams and lotions.
- ii) Do not drink anything other than water for 4 hours before the test.