Q1) What is need of isolation amplifier in biomedical instrumentation set-up. Explain optically isolated isolation amplifier.

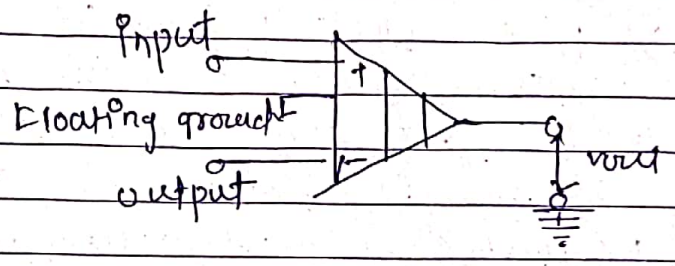
⇒ ① Pre-amplifier isolation circuits.

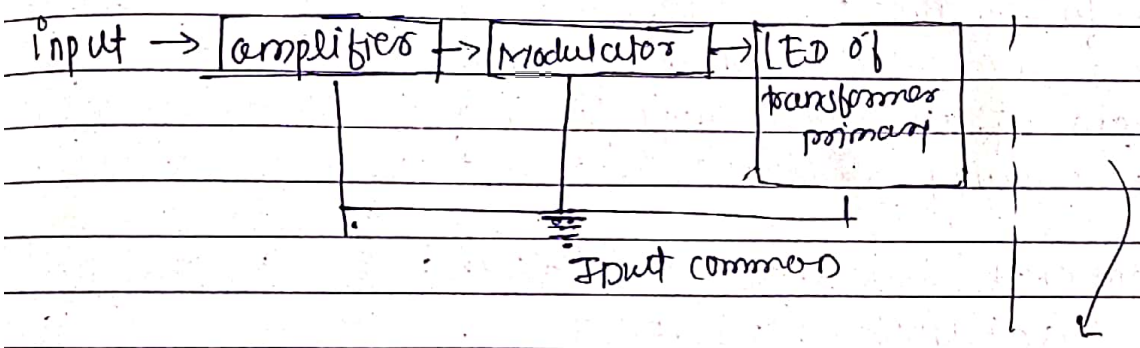
② It increases the input impedance of a patient monitoring system

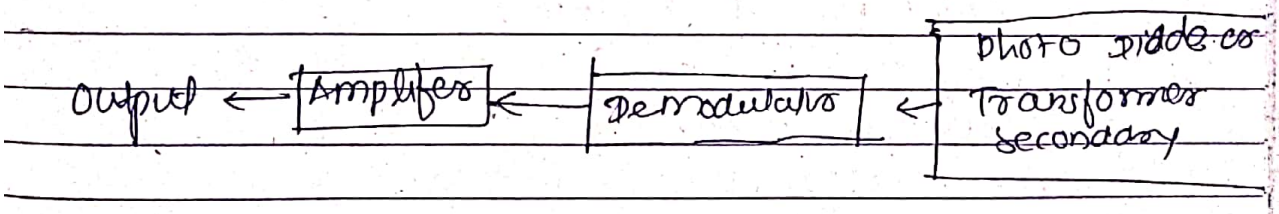
③ It also helps to isolate the patient from the device

④ Using the isolation amplifier prevents accidental internal cardic shock.

⑤ It provides up to $10^{12}\,\Omega$ insulation between the patient and power line in the hospital.







use:

i) It is use in ECG isolation amplifier.

ii) main function of amplifier two increases the input single.

iii) It give as electrical safety barrier as well as isolation

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iv) These amplifier protect the patient from the outflow of current
v) It crack electric signals ohmic continuity among input & output

What is an isolation amplifier?
⇒ An isolation amplifier can be defined as an amplifier which doesn't have any conductive contact among input as well as output section

Q) Effect of MRI - Biological
⇒ i) It affect patients, staff and other person within the MR environment
ii) Biological effect due to electromagnetic source utilized in MRI.
iii) Magnetic Resonance imaging is considered a safe technology since it just has the ability to change the position of atoms but not to alter their structure composition and properties as the ionizing radiation attempt to do

- metal prosthese (Damage due to MR)
- artificial heart valve
- implantable defibrillator
- cardiac pacemakers
- cochlear implant
- Accessories such as ring and ear ring
- instrauterine device.

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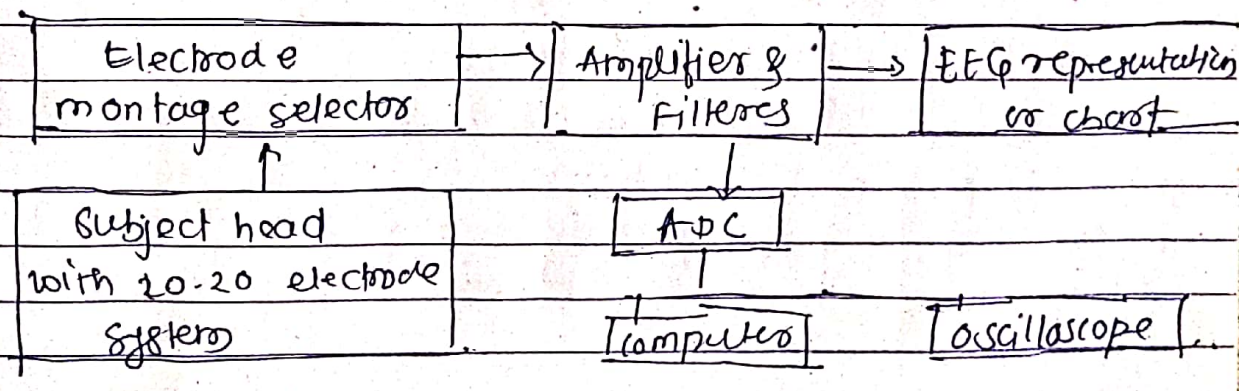
Damge from the dye used in the test
- Tried
- Fatigue
- rash
- Headche
- dizziness

- Biological effect of MRI
  i) Exposure to radio waves may cause the patient to feel numbness
  ii) tattoos on the skine or permanent cosmetics made of mineral components caused some damages such as first and second degree burns.
  iii) temporarily may increase the temperature of patient body
  iv) May cause nausea
  v) The tissues of the eyes and testicles are affected by high temperatures due to the lack of water in them.

* EEG:

Block diagram of EEG



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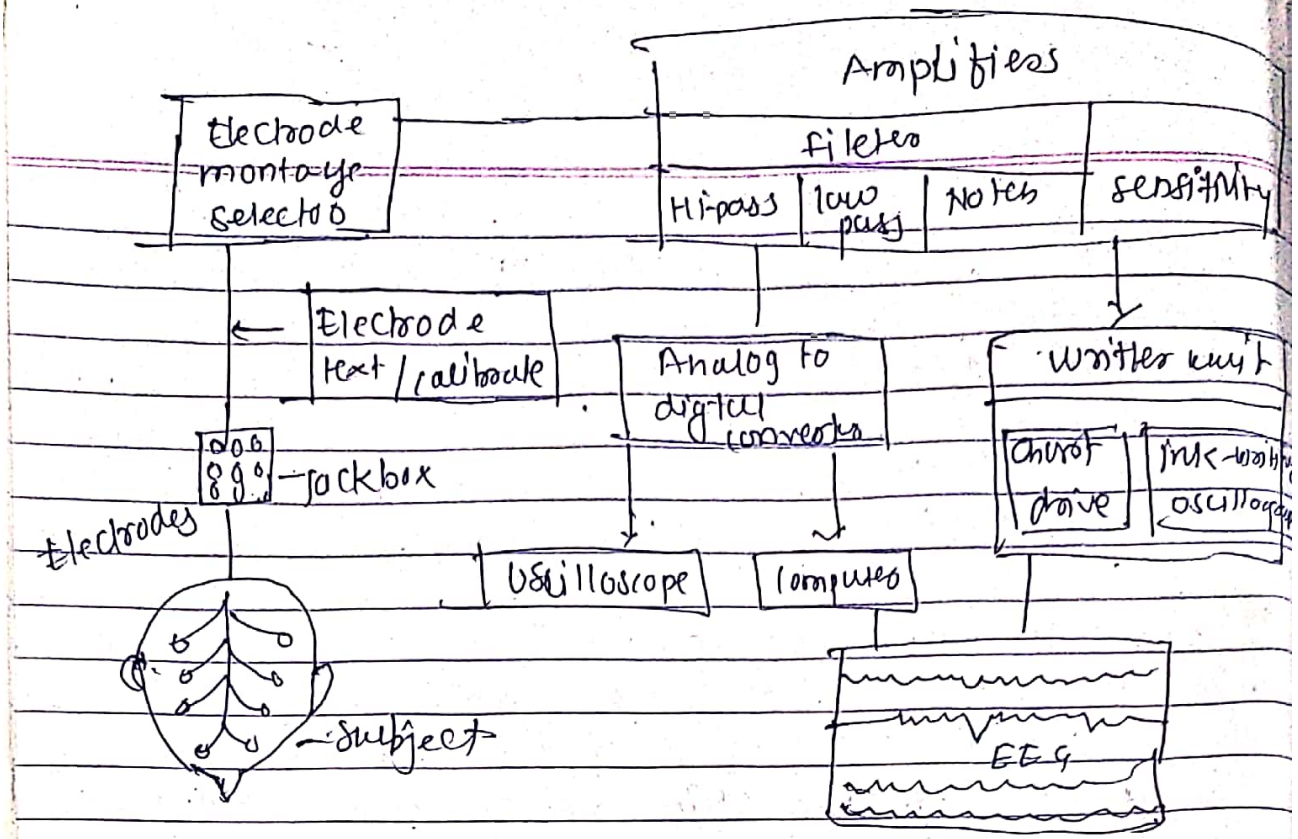

Electroencephalography (EEG) is an efficient modality which help to acquire brain singnals corresponds to various states from the scalp surface area. These singnals are generally categorized as delta, theta, alpha, beta, and gamma on singnal frequencies ranges from 0.1 Hz to more than 100 Hz.

Q) what are type of electrosurgery?

⇒ (1) Electrocautery (2) electrosurgery

(1) Electrosurgery =

which is alternating current. with this techique a surgon can achieve hemostasis in a wet surgical field. the damage to tissue may impair wound healing. By this we can make precise cut with limited blood loss.

In electrosurgical procedures the tissue is heated by an electric current. Although electric devices that create a heated probe may be used for cauterization of issue.

uses radio frequency (RF) alternating current to heat the tissue by RF induced intracellular oscillation of ionized molecules that result in ovation of temperature. when ~~Intermolec~~ intracellular temp reaches 60°c instantaneous cell death occurs when temp grows 60-99°c simultaneous processes of tissue desiccation (dehydration) protein coagulation occure.

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Q)

Dialyzer:

— It's also known as "Artificial kidney".

— It is a box or tube with 4 ports:-

1) — Two port communicate with blood compartment

2) — Two port communicate with dialysis soln compartment

— It is place where the blood & dialysis soln circuit meet & movement of molecules take place betn blood compartment and dialysis solutions compartment

Types of dialyzer

① coil dialyzer

② Parallel plate dialyzer

③ Hallow fibers dialyzer

Types of membranes are currently used in

① Cellulose

② Substituted cellulose

③ Cellulosynthetic

④ Synthetic.

① Cellulose-

The cellulose is obtained from processed cotton

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when is dialysis needed?

⇒ you need dialysis if your kidneys no longer remove enough wastes and fluid from your blood to keep you healthy. this usually happens when you have only 10-15 percent of your kidney function left. you may have symptoms such as nausea, vomiting, swelling and fatigue. However, even if you don't have these symptoms yet, you can still have a high level of wastes in your blood that may be toxic to your body. ~~your doctor~~ is the

AED) Defibrillators

These are device that send and electric pluse or shock to the heart to restore a normal heartbeat. They are used to prevent or correct an arrythemia an uneven heartbeat that is too slow or too fast.

working: (AED's work)-

It is lightweight-battery-operated portable device that check the heart's rhythm and sends a shock to heart to restore normal rhythm. - The device is used to help people having cardiac arrest.

Sticky pad with sensor ~~are~~ called electrode are attached to the chest of someone who having cardiac arrest The electrodes send information about person's heart rhythm to a computer in AED. the computer analyzes the heart rhythm to find out whether an electric shocked needed. if it is needed the electrode deliver the shock.

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* PAcemakers:

to deliver controlled eletrical impulse of specice area of heart to restored normal activity and improve Heart function.

- It consist of:
  1. pulse generator inside pacemaker box.
  2. pacing leads to carrey electrical signals

Type of peacemakers:
1. single-chamber peacemaker (one lead
2. Dual-chamber peacemaker (two lead)
3. Biventricular peacemaker (used in cardiac resynchronization therapy)

* attached to the upper or lower heart chamber

1. single chamber peacemaker:

This type of peacemaker has one lead that connects the pulse generator to one chamber of your heart.

For most people we use the single chamber pacemaker to control heartbeat pacing by connecting the lead to your right ventricle (lower heart chamber) depending on your symptoms and the type of pacing you need we connect the lead to your right atrium (upper heart chamber) to stimulate the pacing in that chamber.

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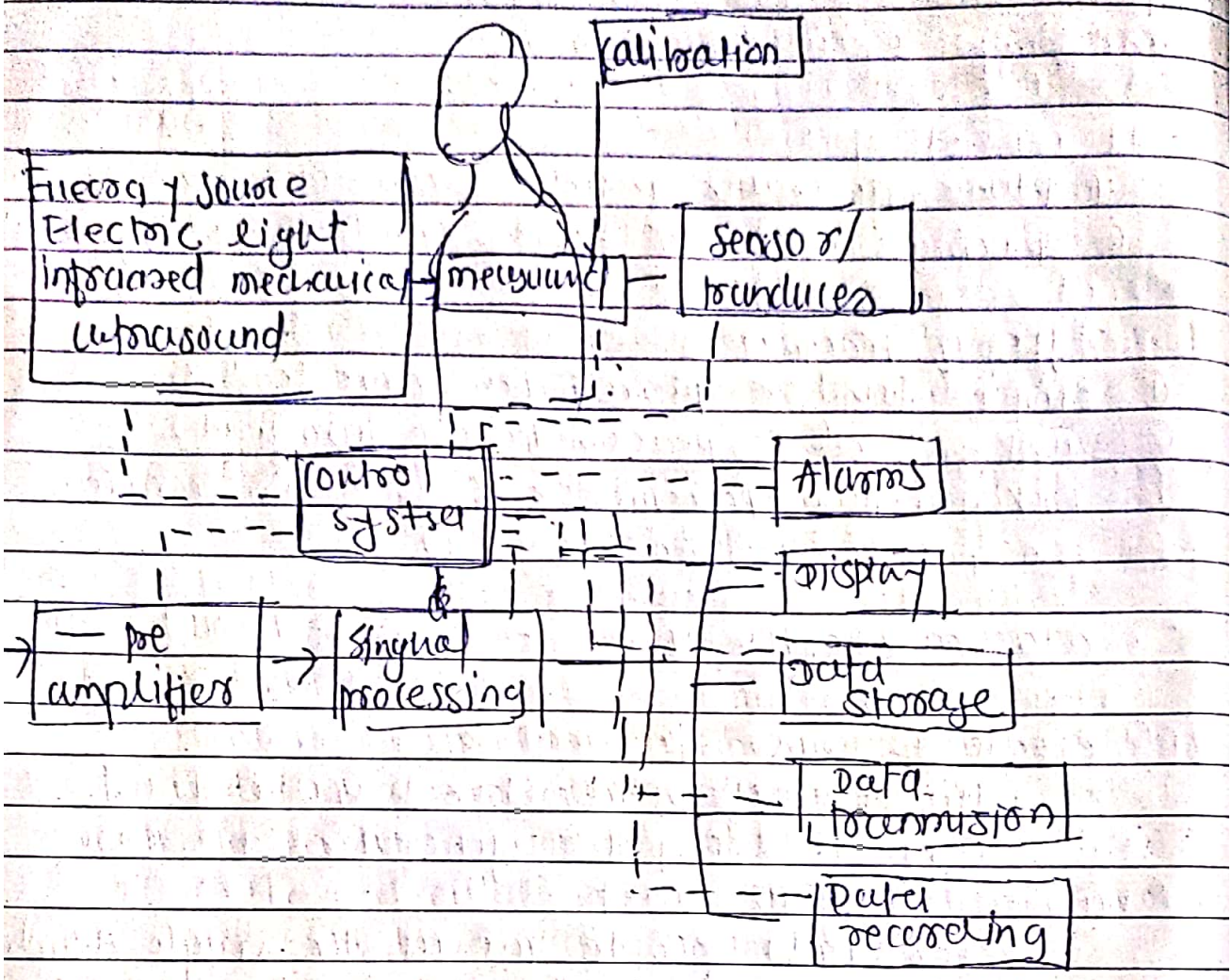
Q ①

Generalised Medical instrumentation system



① Measurand:

The measurand is a physical quantity and the instrumentation system measure it human body acts as the source for measurand and it generates bio-signals

② sensor / transducer.

The transducer convert one form of energy into another form usually eletrical energy The transducer produce a usable output depending

on the measurand. The sensor is used to sense the signal form the source.

3) Signal processor:

signal conditioning circuit are used to convert the output form of transducers into an eletrical value. The instrument system sends this quantity to the display or recording system. Generally signal processing includes amplification, filtering, analogue to digital and Digital to analog conversion it improves the sensitivity of instrument

4) Display:

It is used to provide visual representation of the measured parameter or quantity.
Ex. ~~Cat~~ CRO, chart recorder, something cram also used for audio signal.

5) Data storage:

It is used to stored the data and used it further references.

6) Data transfer:

It is used in telemetric systems where data can be transmitted form one location to another remotely

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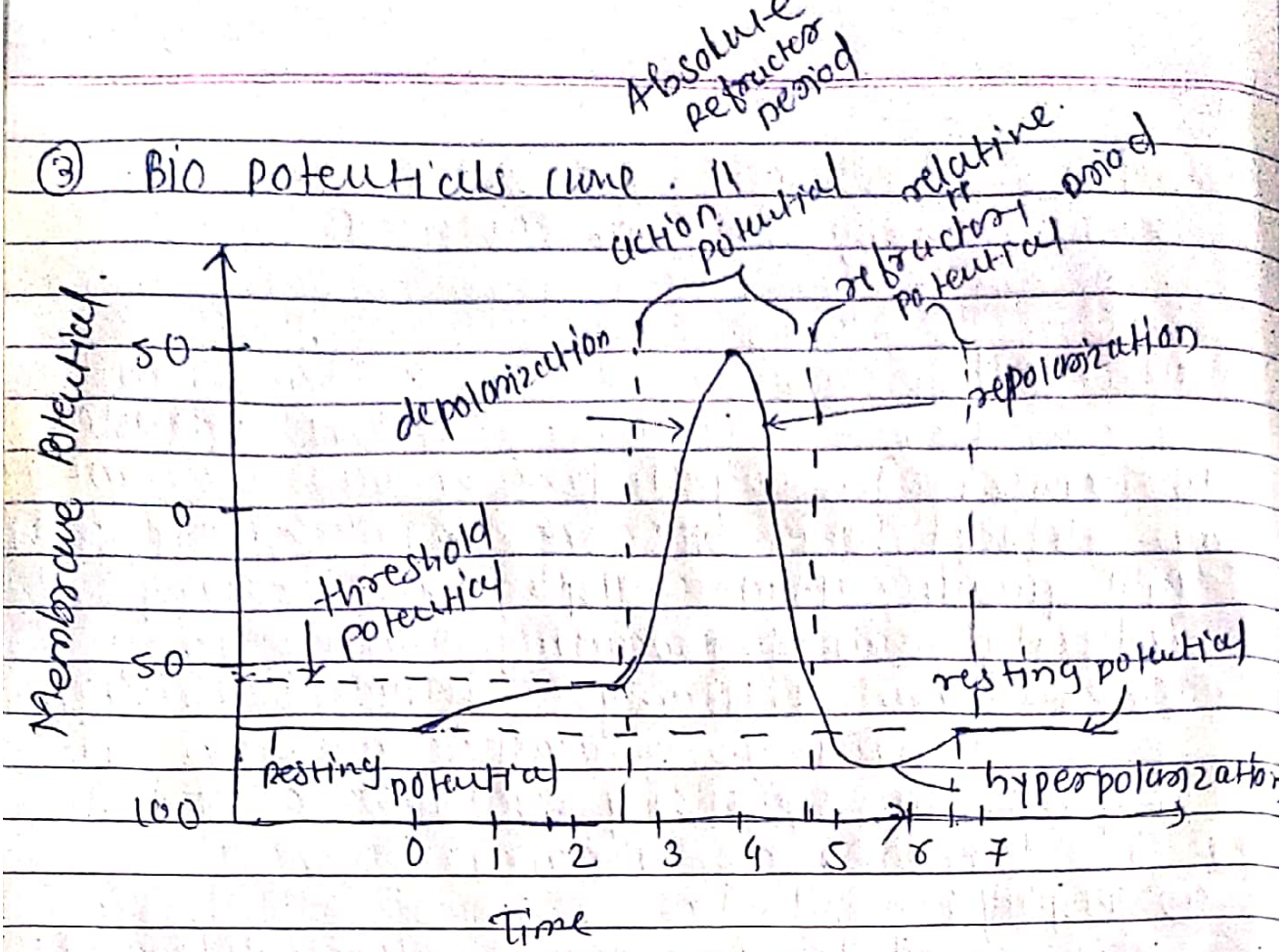
③ Bio potentials curve. 11



① Absolute Refractory period:

When particular patch of axonal membrane is undergoing an action potential. It cannot initiate another action potential

The absolute Refractory period corresponds to the period of action potential from the firing level until repolarization is almost one third complete.

During this stage the voltage gated Na+ channels are closed but incapable of opening. Sodium channel conformation cannot open unless membrane potential come back to the resting level

② Relative Refractory Period.

A period during which second action potential can be produced only by a stimulus stronger than usual.

It extends form end of absolute refractory period

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- during this stage the Na+ channels are closed but capable of opening and voltage gated potassium channels are still open
- the membrane potential more negative.
- The larger fraction of the Na channels must be opened to reach the threshold
- Stronger stimulus is to be applied.

① Resting membrane potential:

transport of substance across the cell membrane is "diffusion" Diffusion generate membrane potential. The ions try to balance betn inside and outsid cell during ~~open~~ diffusion when a cell does not send signal it is resting state. at resting state inside of cell is negative compared to outside of cell.

~~② Action membrane potential:~~

The membrane of excitable cell permits entry of potassium and chloride (negative ions) but block the entry of sodium ions (positive) ions

② Action membrane potential:

The sodium ions are rushed into the cell. At same time potassium ions try to move from inside but unable to move as rapidly as sodium ions. As a result cell has slightly positive potential inside this potential is called Action potential.

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(4)

(1) Electrocardiogram (ECG)

An eletrocardiogram is a simple test that can be used to check your hert's rhythm and electrical activity

(2) Electroencephalography (EEG)

It is a test that measures electrical activity in the brain using small, metal discs ~~et~~ (electrode) attached to the scalp.

(3) Electromyography (EMG)

It is a diagnostic procedure to asses the helth of muscles and the nerve cells that control them

(4) Phonocardiogram (PCG)

It is a plot of high-fidelity recording of the sound and murmurs made by the hearts with the help of the machine called the phonocardiograph.

(5) Vectorcardiography

It is method of recording the magnitude and direction of eletrical force that are generated by the hart by means of continuous series of vectors that form curving lines around a central point

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(5) Nerve cells:

These are special cell send and recive electrical signals through your body to tell it what d to do

Central Nervous system:

brain and spinal chord make up your CNS your brain uses your nerves to send messages to the rest of your body. Each nerve has a protective outer layer called myelin myelin insulates the nerve and helps the messages get through

~~Pe~~ Peripheral nervous system:

your peripherial nervous system consists of many nerves that branch out form your CNS all over your body this system relays information from your brain and spinal cord to your organs, arms, legs fingers and toes your peripherial nervous system contains your

(1) somatic nervous system
(2) Automatic nervous system.

(6) Type of biosensor:

(1) enzyme-Based sensor:
(2) Microbe-Based- or cell Based sensor
(3) Immunosensors
(4) DNA Biosensor
(5) Magnetic biosensors
(6) thermal biosensor
(7) piezoelectric biosensors
(8) optical biosensors

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(2)

compound Action potentials:

It is a signal recorded form nerve trunk made up of numerous axons. It is the result of summation of many action potential from the individual axons in the nerve trunk

Syncapse:

It is called as neuronal junction the site of transmission of electric nerve impulse betn two nerve cells or betn a neuron and a gland or muscle cell.

* ~~Neuro~~ Neuro-myo-junction (neuromuscular junction)

It is also called myoneural juction

- Site of chemical communication betn a nerve fibre and muscle cell.

* motor unit:

It is made up of a motor neuron and all of the skeletal muscle fibers innervated by the neuron's axon terminals, including the neuromuscular junction betn the neuron and fibers.

Group of motor units often work together as a motor pool to coordinate the contraction of a single muscle.

* Reflex:

An action or movement that is made automatically without thinking as a reaction to a stimulus.

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