DEPARTMENT OF BIOMEDICAL ENGINEERING

BM3491 Biomedical Instrumentation

UNIT-II BIOSIGNAL CHARACTERISTICS

2.1 Bio signals characteristics – ECG-frequency and amplitude ranges

A bio signal can be defined as a physiological phenomenon, a body variable that can be measured and monitored. Since the number of physiological mechanisms is nearly unlimited, the diversity of bio signals is huge.

Types of Bio signals: 1. Intrinsic/Extrinsic to body: This first method takes the existence of bio signals as a way to classify them, dividing the bio signals into

- Permanent Bio signals: This kind of bio signals exist without any excitation from outside body and are always present in the human body because source is inside the body.
- Induced Bio signals: This group of bio signals includes bio signals that are artificially induced. In contrast with the permanent bio signals this one's exist only during the excitation. It means that, when the artificial induction is over the induced bio signal decays with a time constant determined by the body properties.

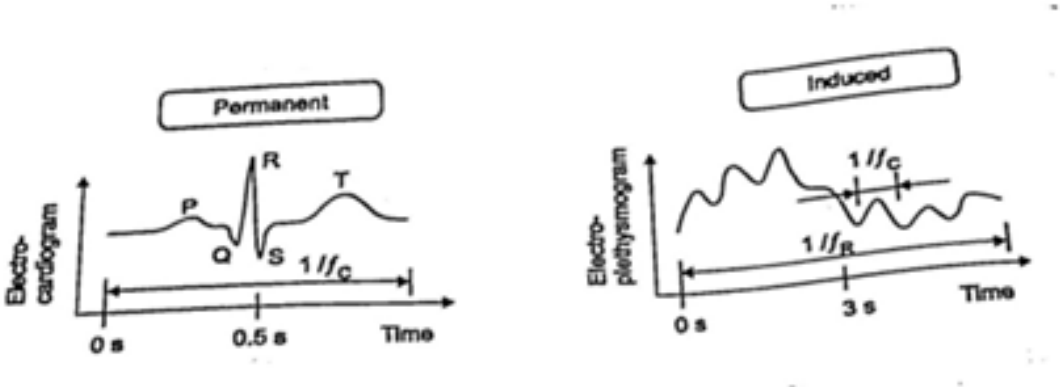


Fig: Permanent and Induced Bio Signals

2. **Static/Dynamic:** The second method takes in consideration the dynamic nature of the bio signal according to:

• Static bio signal: Static bio signals carry information during their steady-state lever which may show slow changes over the time.

• Dynamic bio signal: Dynamic bio signal shows big changes during time.

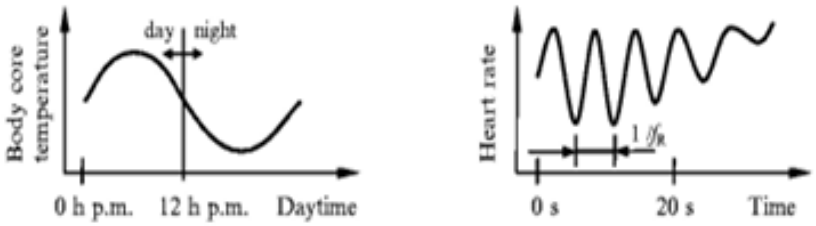


Fig: Static and Dynamic bio signals

3. Origin: The last method is using the origin of the bio signal as a basis for their classification, here are some examples

➢ Electric bio signals

➢ Magnetic bio signals

➢ Mechanic bio signals

➢ Optic bio signals

➢ Acoustic bio signals

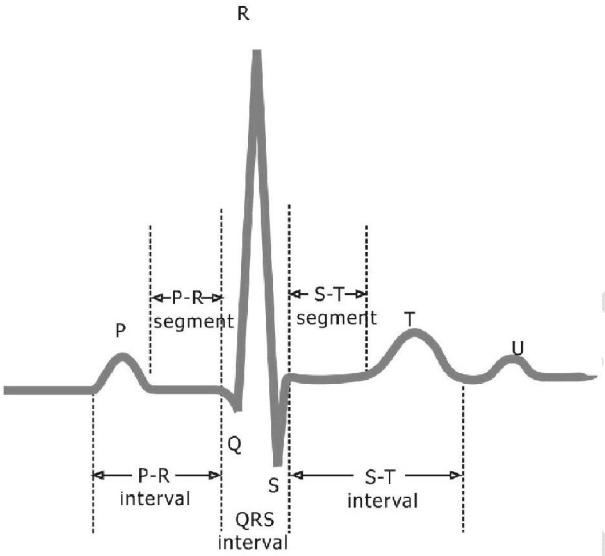
➢ Chemical bio signals

➢ Thermal bio signals

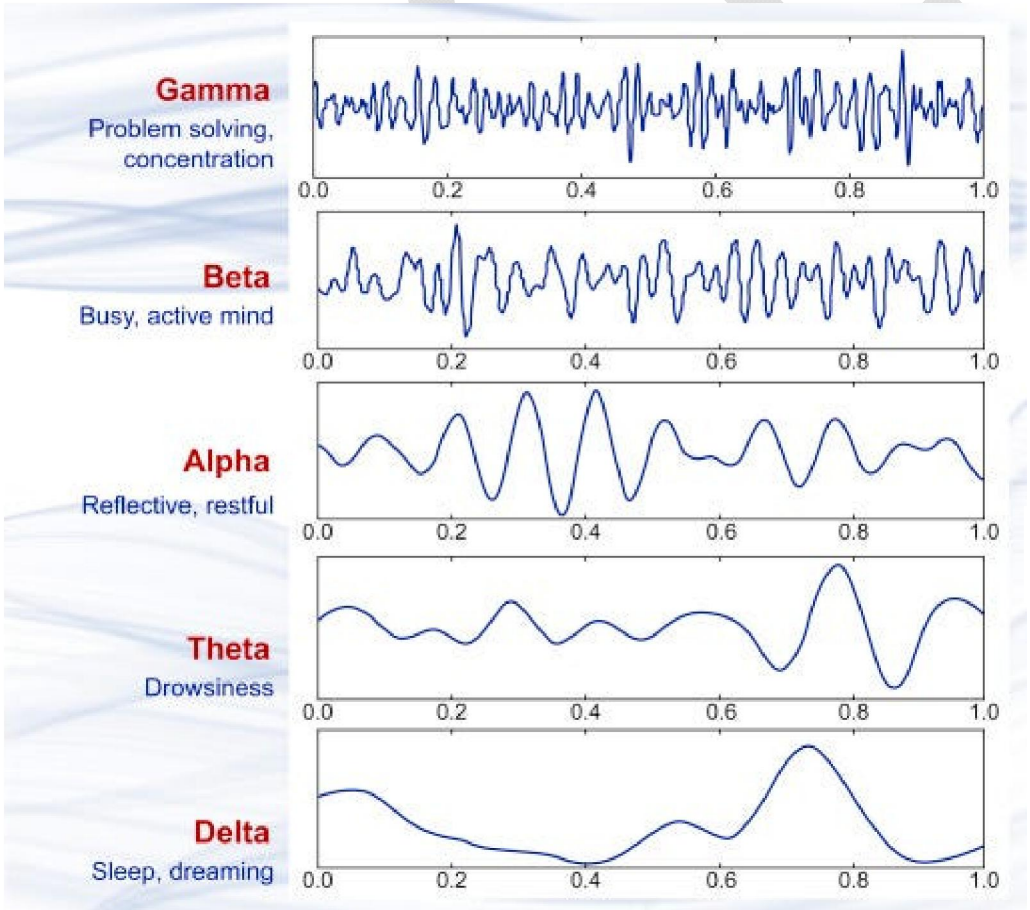
Electrical biosignals, or bioelectrical time signals, usually refers to the change in electric current produced by the sum of an electrical potential difference across a specialized tissue, organ or cell system like the nervous system. Thus, among the best-known bioelectrical signals are:

- Electroencephalogram (EEG)
- Electrocardiogram (ECG)

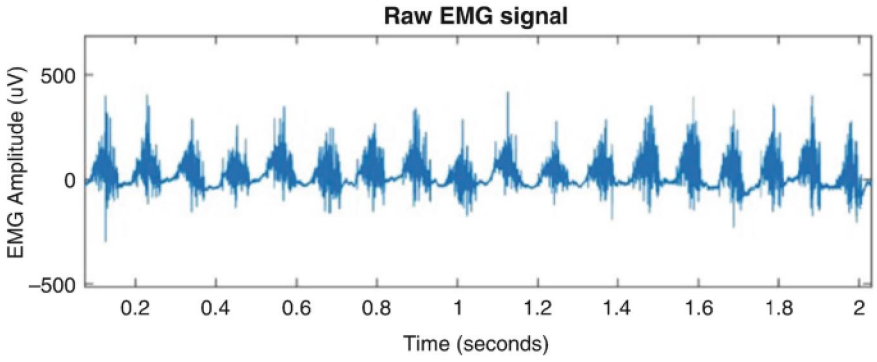
- Electromyogram (EMG)
- Electrooculogram (EOG)
- Electroretinogram (ERG)
- Electrogastrogram (EGG)
- Galvanic skin response (GSR) or electrodermal activity (EDA)



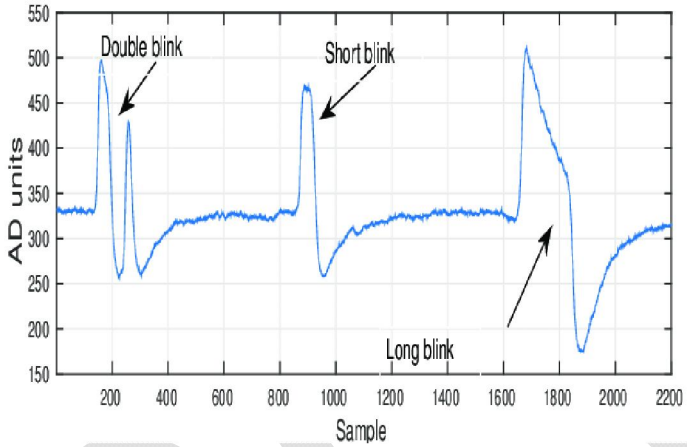
Electrocardiogram (ECG)



Electroencephalogram (EEG)



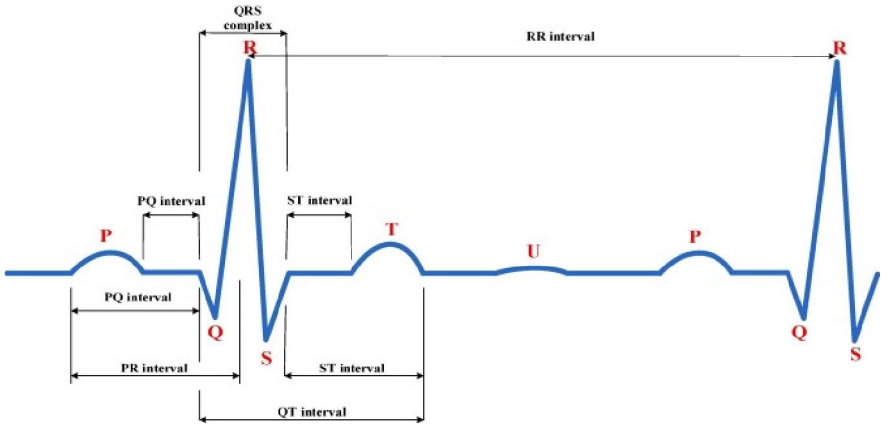
Electromyogram (EMG)



Electrooculogram (EOG)

Frequency and Amplitude Ranges ECG Waveform:

The electrocardiograph (ECG) is an instrument, which records the electrical activity of the heart. Electrical signals from the heart characteristically precede the normal mechanical function and monitoring of these signals has great clinical significance. ECG are used in catheterization laboratories, coronary care units and for routine diagnostic applications in cardiology.



The relaxation of heart muscles is called electrical repolarisation. Relaxed heart chambers are called diastolic.

S.No	Wave	Origin	Amplitude (mv)	Duration (seconds)
1	P wave	Due to depolarization of atria	0.25	0.12 to 0.22 (PR interval)
2	R wave (QRS Complex)	Due to repolarization of atria and ventricle contraction	1.60	0.07 to 0.1
3	T Wave	Due to relaxation of myocardium	0.1 to 0.5	0.05 to 0.15 ST interval
4	ST interval	Contraction of ventricles	…	
5	U Wave	Due to slow expansion of purkinje fibers	….	0.2 (T-U interval)

The first little upward notch of the ECG waveform is called the P wave. The P wave indicates that the atria are contracting to pump blood. The next part of the ECG is a short downward section connected to a tall upward section. This part is called the QRS complex. When the Bundle of His fires, the ventricles contract to pump blood. The large amplitude of voltage is required because the ventricles are the most muscular and dense part of the heart. The next upward curve is called the T wave. The T wave indicates the resting period (repolarization) of the ventricles.

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