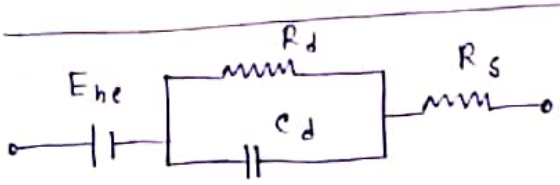
3) or

Electrical equivalent circuit of a surface electrode.



C_d → capacitance of electrode electrolyte interface

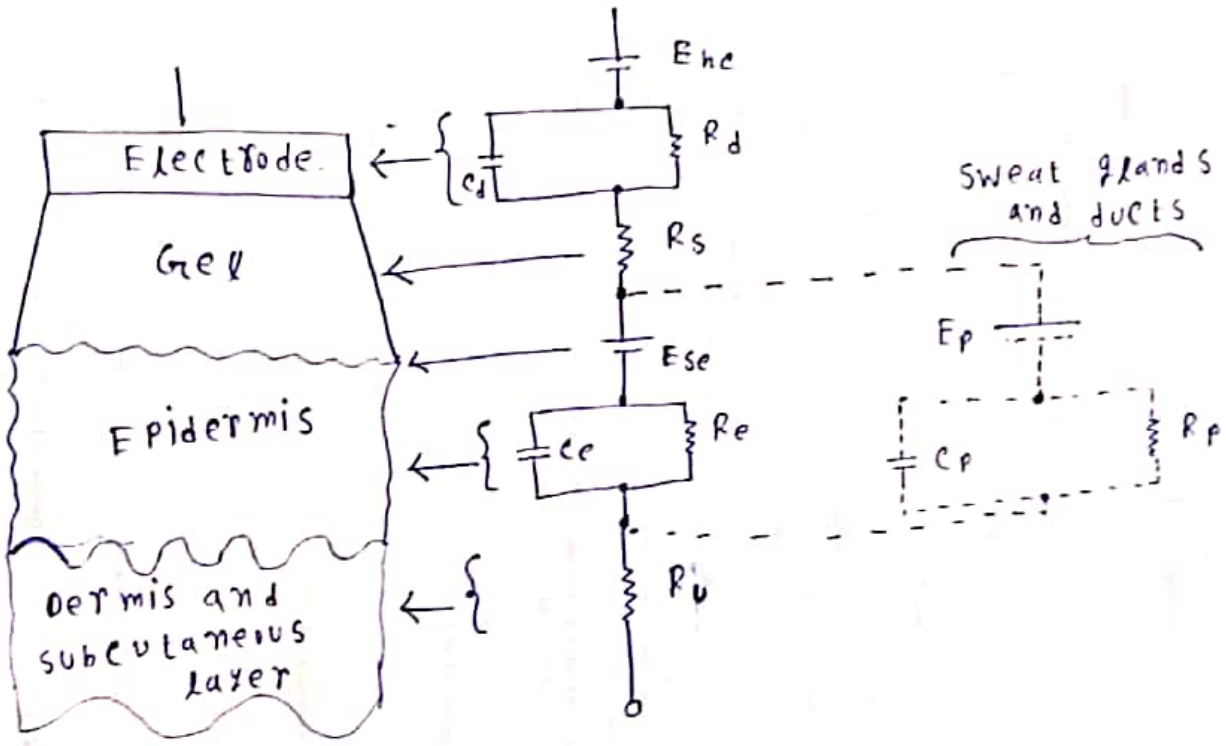
R_d → Resistance of electrode - electrolyte interface.

R_s → Resistance of electrode lead wire.

E_{he} → Half cell potential for electrode.

Electrode skin interface.

- A body surface electrode is placed against skin, showing the total electrical equivalent circuit obtain in this situation

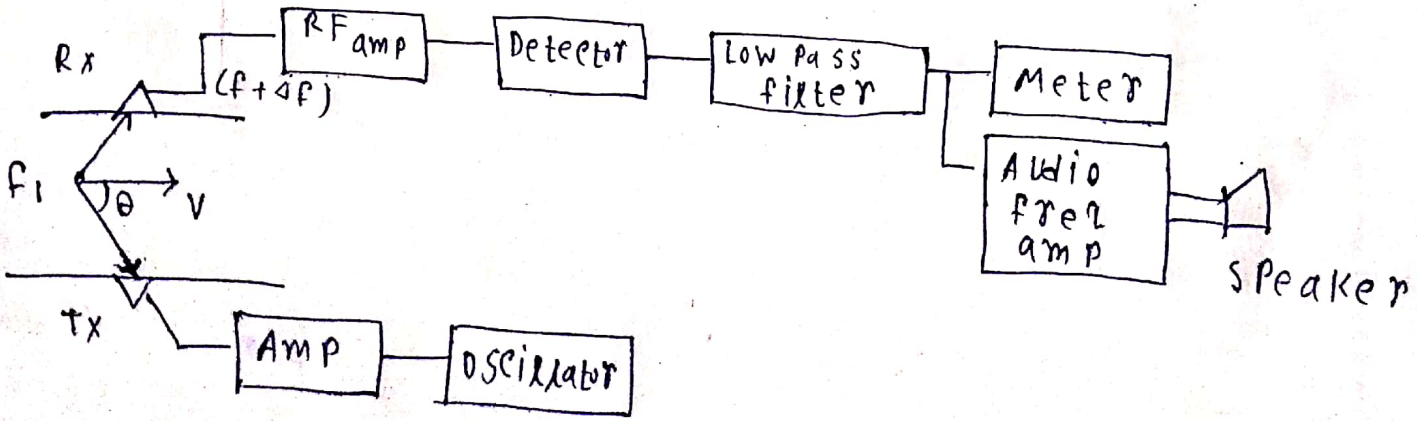


5) What do you mean by doppler effect?

Ans: The doppler effect is the change in frequency of a wave for an observer moving relative to its source. It is commonly heard when a vehical sounding a siren or horn approaches, passes and recedes from an observer. Compared to the emitted frequency, the receiver frequency is higher during the approach, identical at the instant of passing by, and lower during the recession.

Doppler effect applied in blood flow measurement.

Dopper effect is applied in Ultrasonic blood flow meter.



doppler effect equation.

$$f' = \frac{f(c + v_d)}{f(c \mp v_s)}$$

$v_s = 0$

$$f' = \frac{f(c \pm v_d)}{c}$$

$v_d = 0$

$$f' = \frac{fc}{c \mp v_s}$$

$$f_1 = \frac{f(c - v\cos\theta)}{c}$$

$$f_2 = \frac{f_1 c}{c + v\cos\theta}$$

$$\Delta f = f_1 - f_2$$

$$= f - \frac{f_1 c}{c + v\cos\theta}$$

$$= f - \frac{f(c - v\cos\theta)}{(c + v\cos\theta)}$$

$$\Delta f = \left(\frac{2v\cos\theta}{c + v\cos\theta}\right) f \quad [c = \text{velocity of sound}].$$

$$\Delta f \approx \frac{2v\cos\theta}{c} f$$

$$\Delta f \propto v$$

List and define term of selection criteria of transducers for biomedical applications.

i) Accuracy = It is the algebric difference between the indicated value and the true or theoritical value of the measurand.

ii) Precision = It refers to the degree of repeatability of a measurement.

iii) Resolution :- The resolution of a transducer indicates the smallest measureable input increment.

iv) Sensitivity :- It describes transfer ratio of o/p to i/p.

v) drift :- It indicates change of baseline or of sensitivity with time, temp. etc.

vi) Linearity :- It shows closeness of transducer's calibration curve to a specified straight line with in a given percentage of full scale output.

vii) Noise :- This is an unwanted signal that at the o/p due to either internal source or interference.

1. Draw and discuss the basic block diagram of bio-instrumentation system

A Bio instrumentation deals with measurement and analysis of current or voltage signals from different parts of the body. The human body is like power station which generates a variety of voltages. The generated voltages are extremely small. In most of the bio instrumentation systems, currents between two points on the surface of the body due to p.d b/w the two points are measured. These currents are very small, of the order of micro and are therefore amplified by instrumentation amplifiers. After amplification the signal is processed noise is filtered, bandwidth is restricted & then it is either displayed on CRT, a strip chart recorder or a camera or a magnetic tape. In some cases, an external stimulus is given to the patient and the response to the stimulus which is a voltage signal is recorded. Sometimes transducers are required to obtain an electric signal. Many physiological process in the body are accompained with electrical changes. Signals are produced in the body by muscles & nerves.