



Important Instructions to examiners:

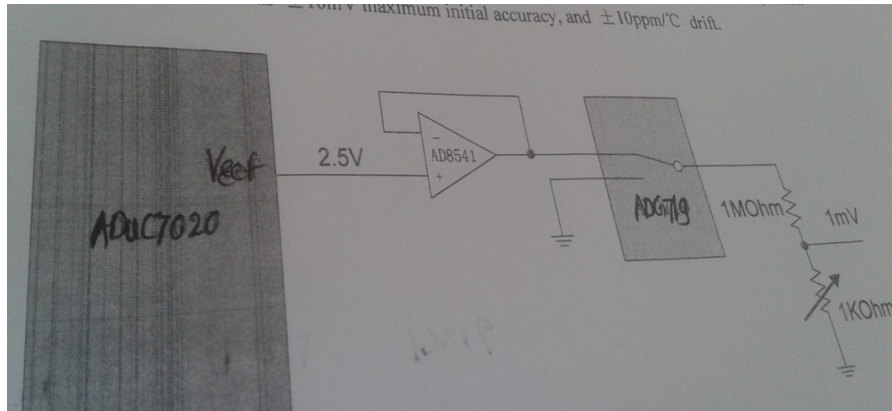
- 1) The answers should be examined by key words and not as word-to-word as given in the model answer scheme.
- 2) The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate.
- 3) The language errors such as grammatical, spelling errors should not be given more Importance (Not applicable for subject English and Communication Skills.)
- 4) While assessing figures, examiner may give credit for principal components indicated in the figure. The figures drawn by candidate and model answer may vary. The examiner may give credit for any equivalent figure drawn.
- 5) Credits may be given step wise for numerical problems. In some cases, the assumed constant values may vary and there may be some difference in the candidate's answers and model answer.
- 6) In case of some questions credit may be given by judgement on part of examiner of relevant answer based on candidate's understanding.
- 7) For programming language papers, credit may be given to any other program based on equivalent concept.



	<p>Description : The sensor of pulse oximeter consists of red and infra-red light sources and detector. The LED driver provides drive to red and infrared LED's. The red and infrared LED's are illuminated separately so that photo sensor output represents a signal firstly from one LED and then from the other. This allows signal processor circuitry to determine transmission of intensity of each wave length without interference from the LED. The sensor amplified provides necessary amplification to this signal. The signal is then converted into digital signal by an analog to digital converter. The microprocessor circuitry is under software control and determine the system timing and control logic. The microprocessor also provides display outputs to the display drivers for the front panel display of oxygen saturation and pulse rate.</p>	02
c)	<p>Illustrate following methods to measure heart rate.</p> <ol style="list-style-type: none">1. Bit to Bit2. Combination of bit to bit with average. <p>Ans:</p> <p>1. Beat-to-beat calculation:- This is done by measuring the time(T), in seconds, between two consecutive pulses, and converting this time into beats /min=$60/T$. This technique accurately represents the true picture of the heart rate.</p> <p>2. Combination of beat –to-beat calculation with averaging: This is based on a four or six beats average. The advantage of this technique over the averaging techniques is its similarity with the beat- to-beat monitoring system.</p>	02 02
d)	<p>Describe the significance of vector cardiography.</p> <p>Ans: In the fields of education and research, vectorcardiography provides a better and more rational insight into the electrical phenomena that occurs spatially, and represents an important impact on the progress of electrocardiography. Vectorcardiography represents a source to enrich science by enabling a better morphological interpretation of the electrical phenomena of the heart.</p> <p style="text-align: center;">OR</p> <p>Vectorcardiography is the technique of analyzing the electrical activity of the heart by obtaining ECG's along three axes at right angles to one another. It display any two of these ECGs as a vector display on an X-Y oscilloscope. The display is known as a vector cardiogram (VCG).</p> <p>Vector cardiogram displays the same electrical events simultaneously in two perpendicular axes. This gives a vectorial representation of the distribution of electrical potentials generated by the heart, and produces loop type pattern on the CRT screen. Usually a photograph is taken of each cardiac cycle. From such picture, the magnitude and orientation of the P,Q, R, S and T vector loops are determined. VCG illustrates the phase difference between the voltages and also the various leads from which it is derived. The major information that it provides is the direction of depolarization and repolarization of the atria and the ventricle.</p>	04
B)	<p>Attempt any ONE :</p> <p>a) Draw following circuits used in ECG machine and state their importance.</p> <ol style="list-style-type: none">i) 1 mV Calibration circuitii) Wilson network	06

Ans : (Draw 2m each and importance 1m for each circuit)

i) 1 m V Calibration circuit :



The electrical activity detected by the ECG machine is measured in millivolts. Machines are calibrated so that a signal with an amplitude of 1 mV moves the recording stylus vertically 1 cm: • 1 small vertical square = 0.1 mV = 1 mm

OR

Is the electrical activity measured and printed correctly?

1) Standard calibration of the ECG is 10mm/mV .

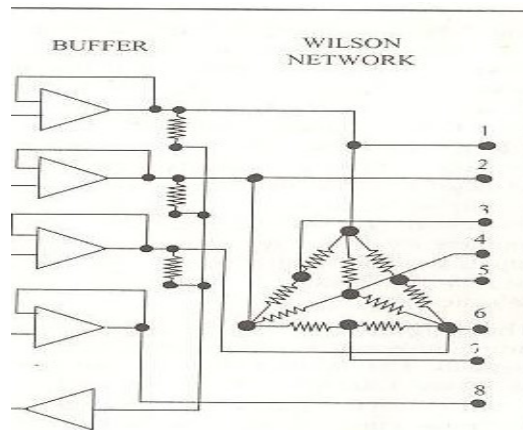
At this calibration, 1 millivolt calibration signal is expected to produce a rectangle of 10 mm height and 5 mm width. If the recording speed of ECG (sweep speed) is adjusted at 50 mm/second,

2) 1 millivolt calibration signal is expected to produce a perfect square with a 10 mm height and 10mm width. When ECG waves are tall, the R or S waves may extend into the QRSComplexes above or below them.

3) To prevent this superimposition, the whole ECG may be calibrated at 5mm/mV .

4) In some patients, 10-5 mm/mV (1-1/2) calibration may be chosen to decrease the amplitude of precordial lead deflections only. This is done to prevent superimposition of the QRS complexes in precordial leads

ii) Wilson network :



Importance :

Wilson network sums the various electrode voltages to achieve the standard voltages for different ECG selection. The multiplexer selects the appropriate lead voltages from register network. Wilson network performs a mixing of summing function and thus provides ECG connections for lead selection.



	<p>b) Suggest trouble shooting techniques for various faults in EEG machine Ans:- (Any three faults 3marks and troubleshooting technique for each fault 1mark)ie(3m+3m)</p> <table border="1"> <thead> <tr> <th>Symptom</th> <th>Reasons</th> <th>Troubleshooting</th> </tr> </thead> <tbody> <tr> <td>1)Machine runs, but the tracing on one or more channels is missing</td> <td>1.Ink reservoirs for pens are dry [on missing channels] 2. Ink tubes are clogged. 3. Pen is not touching.</td> <td>1. Check ink reservoirs. 2. Check ink tubes for clogging. 3. Check for upwardly bent pens-gently push pen onto paper with finger or pencil to observe any touching</td> </tr> <tr> <td>2) Spotty recordings (light or dark).</td> <td>1. Worn pens or incorrectly loaded paper.</td> <td>1. Check paper loading. 2. And if proper, then check pen for worn tip (ink not feeding properly)</td> </tr> <tr> <td>3) Noisy or poor recording.</td> <td>1. Lead connection or electronic or mechanical problems.</td> <td>1 Place selector switches to standard calibration position and check for noise and improper operation. 2. If calibration operation is normal, the problem is properly the patient connection. 3. Grounded all EEG leads and check for straight line tracing (noiseless) and, If good, connect an EEG simulator, if available. Check for good tracings. If noise appears on the trace, the problem is properly inside the machine. Refer to the service manual for troubleshooting.</td> </tr> </tbody> </table>	Symptom	Reasons	Troubleshooting	1)Machine runs, but the tracing on one or more channels is missing	1.Ink reservoirs for pens are dry [on missing channels] 2. Ink tubes are clogged. 3. Pen is not touching.	1. Check ink reservoirs. 2. Check ink tubes for clogging. 3. Check for upwardly bent pens-gently push pen onto paper with finger or pencil to observe any touching	2) Spotty recordings (light or dark).	1. Worn pens or incorrectly loaded paper.	1. Check paper loading. 2. And if proper, then check pen for worn tip (ink not feeding properly)	3) Noisy or poor recording.	1. Lead connection or electronic or mechanical problems.	1 Place selector switches to standard calibration position and check for noise and improper operation. 2. If calibration operation is normal, the problem is properly the patient connection. 3. Grounded all EEG leads and check for straight line tracing (noiseless) and, If good, connect an EEG simulator, if available. Check for good tracings. If noise appears on the trace, the problem is properly inside the machine. Refer to the service manual for troubleshooting.	<p>06</p>
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<p>Q2</p>	<p>a) Attempt any Four : Describe operation of digital blood pressure meter with suitable diagram. Ans : (Any other relevant diagram should be considered)</p> <ul style="list-style-type: none"> • Blood pressure monitors can use Korotkoff, Oscillometry, or Pulse Transit Time methods to measure blood pressure. • They employ a pressure cuff, pump, and transducer to measure blood pressure and heart rate in three phases: Inflation, Measurement, and Deflation • . They include an LCD, selection buttons, memory recall, power management, and USB interface. • The pressure transducer produces the output voltage proportional to the applied differential input pressure. • The output voltages of the pressure transducer range from 0 to 40 mV, which need to be amplified so that the output voltage of the DC amplifier has a range from 0 to 5V. Thus, we need a high-gain amplifier • . Then the signal from the DC amplifier will be passed on to the band-pass filter. The DC amplifier amplifies both DC and AC component of the signal. 	<p>16</p> <p>02</p>												

- The filter is designed to have large gain at around 1-4 Hz and attenuate any signal that is out of the pass band. The AC component from filter is important for determining when to capture the systolic/diastolic pressures and heart rate of the patient.
- The final stage of the front end is an AC coupling stage, after which the signal is sent to analog to digital converters, and digitized.
- The digital measurements of pressure and heart rate are performed by the microprocessor. Measurements results are stored in EEPROM or FLASH memory as a data log that can be uploaded to a PC via USB.
- The analog circuit is used to amplify both the DC and AC components of the output signal of pressure transducer so that we can use the MCU to process the signal and obtain useful information about the patient's health.

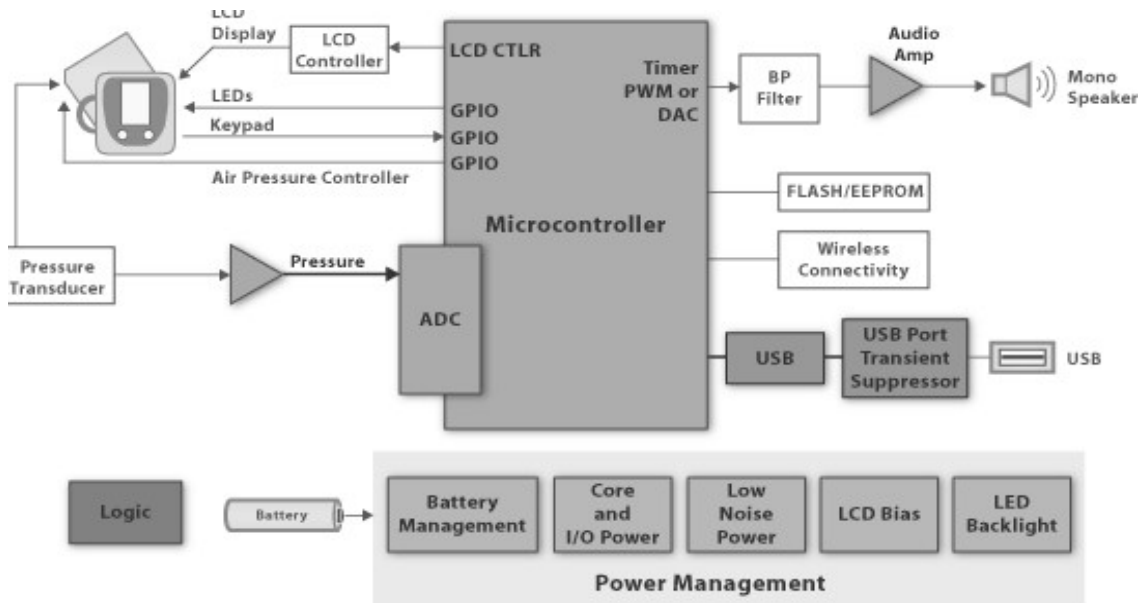


Fig : Digital Blood Pressure meter

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b) Draw block diagram of ultrasonic FHR meter.

Ans:

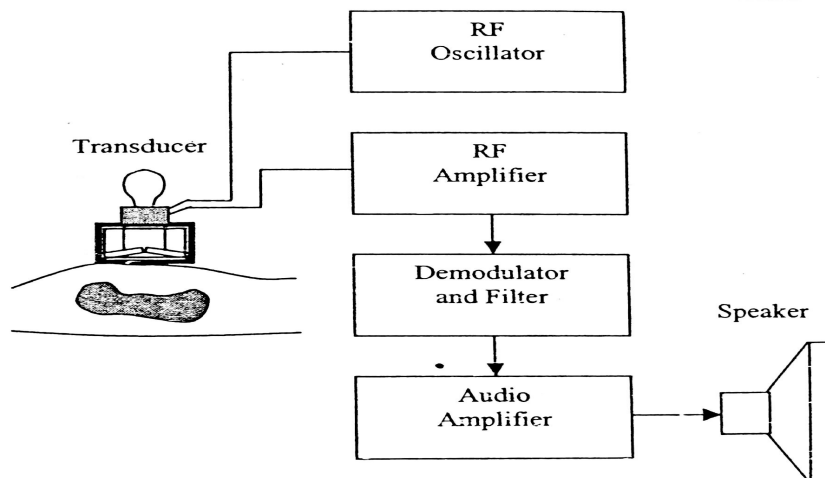


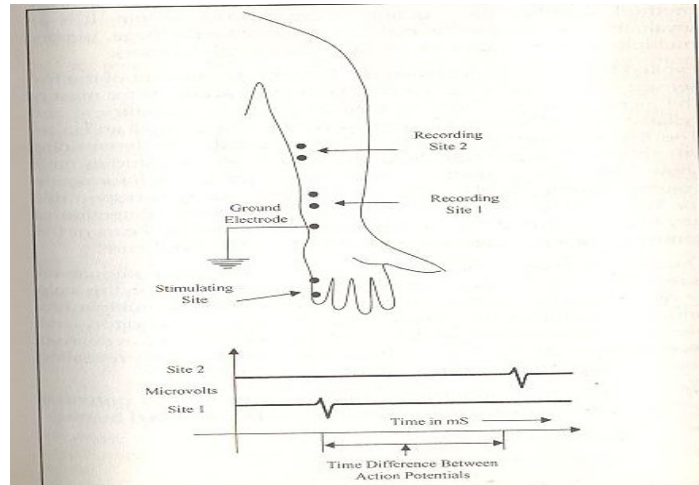
Fig : Fetal heart rate meter

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c)	<p>Give importance of microphone, amplifier and earphone in hearing aid and suggest which type of deficiency of human body it can overcome.</p> <p>Ans : (3m for importance + 1m deficiency)</p> <p>1) Microphone: Picks up sound from air and converts it into electrical signal.</p> <p>2) Amplifier: Increases intensity of signals from microphone.</p> <p>3) Earphone : Used converts electrical signals from amplifier to acoustic signals heard by the user</p> <p>Hearing aid -- used to correct hearing losses of ears.(hearing problems caused by a loss of cochlear hair cells, medically known as sensor neural hearing loss)</p>	04
d)	<p>Describe right leg drive circuit used in ECG machine with suitable diagram.</p> <p>Ans:</p> <div style="text-align: center;"> </div> <p style="text-align: center;">Right leg drive circuit</p> <p>To minimize the common mode signal between the body of the patient and the floating ground a right leg drive circuit is used. The common mode signals after amplification in a preamplifier are inverted and fed back to the right leg electrode reducing the common mode voltage on the input with respect to the floating ground.</p>	02
e)	<p>Describe sensory and motor nerve conduction.</p> <p>Ans:</p> <p>Motor nerve Conduction Velocity is measured from Stimulus site to the muscle as shown in figure below. The peroneal nerve of the left leg is stimulated behind the knee and muscular response is detected in the foot using surface electrodes. A nerve muscle travels downward along with the motor nerve to the recording site on the muscle of a foot. The stimulus should be repeated several times to ensure that the responses obtained are Consistent. Measuring the distance between the stimulating and recording site and dividing it by the latency can determine the nerve conduction .It is possible to measure the motor nerve Conduction velocity between several locations.</p> <div style="text-align: center;"> </div> <p style="text-align: center;">Motor nerve conduction Velocity</p>	02

Sensory Nerve Conduction Velocity:- Sensory nerve conduction velocity is measured by similar technique used for nerve as shown in figure below. Recording electrodes are placed at no. of sites on the sensory nerve under test. In this example an nerve of the hand is considered as shown in fig. And the stimulus is applied at the little finger which is a Stimulation site. The nerve impulse travels upward through the nerve and reaches at recording sites after different time intervals. The Sensory nerve Conduction velocity is measured in the same way as motor nerve dividing the latency by the distance.

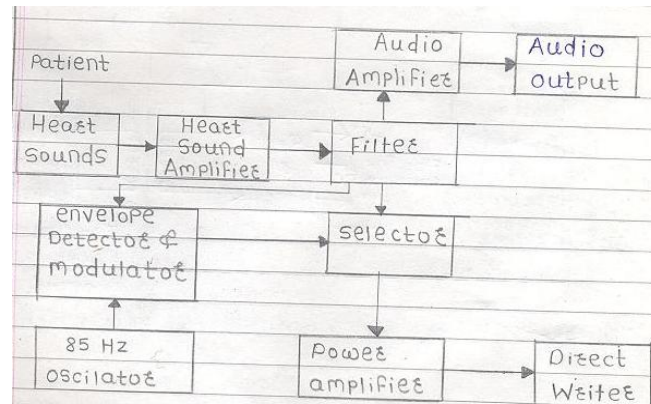
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Sensory Nerve conduction velocity

f) **Draw block diagram of PCG machine and describe it.**

Ans:



Phonocardiograph

Phonocardiograph is an equipment used to record sound generated by heart during are physiological phenomenon. When provides diagnostic information in frequency band from 20-1000 Hz.

Phonocardiograph has 9 Sections

- Input heart sound.
- Heart sounds pre-amplifier.
- Filter
- Audio amplifier
- Audio Output.
- Envelop detector and modulator
- 85 Hz oscillation
- Power amplifier & Direct recorder

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The input sound section receive heart sound signal from the microphone placed on patient's heart and feeds the heart sound amplifier. Two types of microphone are used in PCG. Contact or dynamic microphones for phonocardiography and air coupled crystal microphones for pulse wave phonocardiography. A latest contact microphone has frequency response from 20Hz -1KHz. 5 Steps filter employed here passes the selector band of heart sounds to power amplifier. Heart sounds & murmurs contain frequencies between 20Hz-2KHz. Standard galvanometer record can record the frequency, which are below 100Hz. But phonocardiograph a direct writing hot stylus galvanometer is used to record heart sound & murmurs with special electronic detection method that extracts the shape, timing duration, amplitude of heart sound over entire 20Hz-2KHz spectrum. Signal's envelope is detected & modulated with 85 Hz frequency, which is generated by 85Hz oscillation.

The modulated signals has frequency component of only 85Hz & envelope of acquired heart sound to record the signal using hot stylus galvanometer. At filter positions 25 & 50 being selected band has lower frequency it is recorded directly. On the other hand when filter positions. 100, 250 or 500 are selected signal is modulated & then recorded.

Q3

a) **Differentiate between direct and indirect blood pressure measurement techniques (any four)**

Ans :

Direct Blood pressure	Indirect Blood pressure
Direct B.P. measurement employs catheter insertion in artery or particular part of body	B. P. is Measured without entering into blood vessels
Continuous monitoring of blood pressure changes and blood pressure waveforms	It reveals no blood pressure waveforms.
Method is suitable for monitoring patient in ICCU or operating rooms as it enables continuous monitoring.	Method not so suitable in O.T. or ICCUs
Accurate measurements of venous, arterial or endocardial pressure.	Not Accurate comparatively.

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b) **Describe the concept of fetal heart rate.**

Ans :

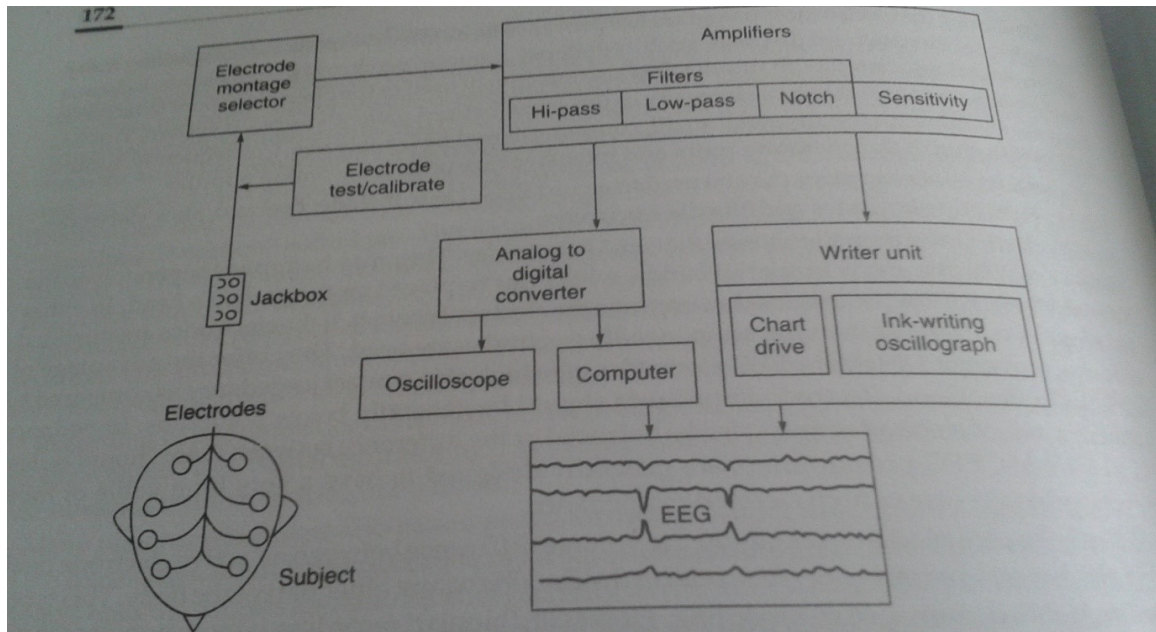
The beating of fetal heart inside the mother's womb can be detected from 11th week of gestation. It is possible to record fetal ECG after 16th week of gestation. It becomes more evident from 24th week.

A normal fetal heart rate (FHR) usually ranges from 120 to 160 beats per minute (bpm) in the in utero period. It is measurable sonographically from around 6 weeks and the normal range varies during gestation, increasing to around 170 bpm at 10 weeks and decreasing from then to around 130 bpm at term. Fetal heart rate below 120 beats per minute are labelled as bradycardia and more than 160 beats per minute is labelled as tachycardia. The use of electronic technique's for continuous monitoring of FHR and uterine contraction have helped us to understand significance of FHR patterns.

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c) Draw block diagram of EEG machine.

Ans :



Electroencephalograph machine

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d) How four sounds are produced by the heart?.

Ans : (1 Mark each= 04)

There are four basic sounds that occur during the sequence of one complete cardiac cycle. The first heart sound is a low pitch sound. It has a frequency in the range of 30 to 45 Hz. This heart sound occurs at the termination of arterial contraction and at the onset of ventricular contraction. This heart sound occurs approximately at the time of the 'QRS' complex of the ECG complex.

2. The second sound is high pitch sound. It has frequency between 50 to 70Hz. It is caused by the closure of aortic and pulmonary valves, which release the blood for systemic and pulmonary circulation. The second heart sound occurs about the time of the end of the 'Wave of the ECG complex. It is louder than first heart sound

3. The third heart sound has a very low frequency, normally below 30 Hz. It is sometimes heard, especially in young adults. This sound occurs from 0.1 to 0.2 second after the second heart sound. It is due to the rush of blood from the atria into the ventricles, which causes turbulence and some vibration of the ventricular walls. This sound actually appears before the atrial contraction.

4. The fourth heart sound is called atrial heart sound, which is not audible but may be visible on graphic recording. This heart sound occurs when the atria actually do contract. The inaudibility of this heart sound is a result of low amplitude and low frequency of the vibration.

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e) Describe the generation of ECG signal.

Ans :

The recording of electrical activity associated with the functioning of the heart is known as ECG signal.

ECG signal is periodical, rhythmically repeating signal synchronized by the function of

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the heart, which act as a generator of bioelectric events.
The position of SA node in the heart from where the impulse responsible for the electrical activity of the heart originates.
The potential field generated by SA node extends to the other parts of the heart.
The wave propagates through the right and left atria.
The action potential contracts arterial muscle and impulse spread through arterial wall to AV node. This corresponds to P wave in ECG graph.
AV node delays the spread of excitation.
Then bundle of His carries the action potential to the ventricles.
The direction of impulse propagating in bundle of His is from the apex of the heart; ventricular contraction begins at the apex and processed upward through the ventricular walls.
This results in the contraction of the ventricles which produce squeezing action which forces the blood out of the ventricles into arterial system. This corresponds to QRS complex in ECG graph. And the repolarization of ventricles corresponds to T wave in ECG graph.

Q.4 A Attempt any three of the following:

a) State effects of removing of comparator and monostable multivibrator from respiration rate meter.

Ans :

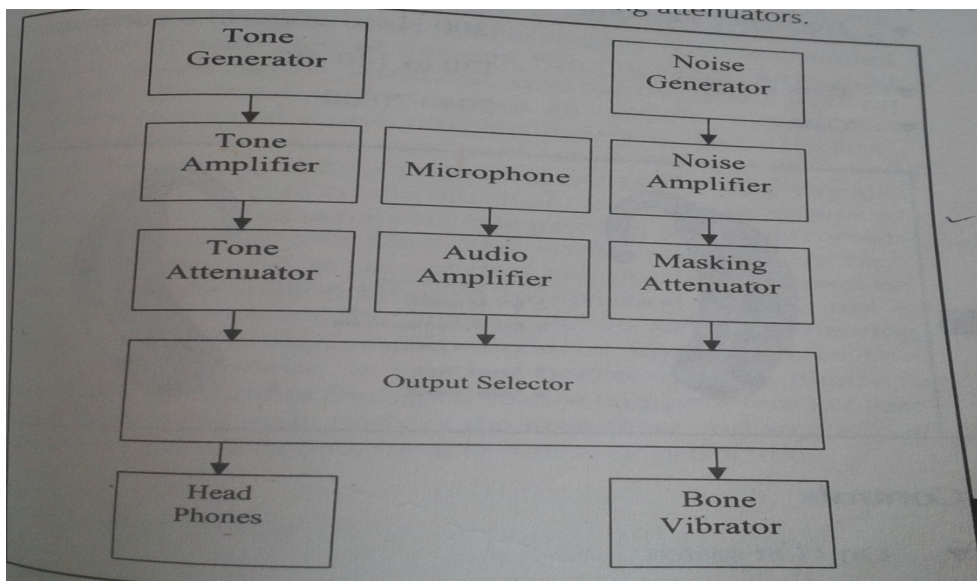
Comparator: Here an amplified pulse is compared with reference voltage to produce a trigger pulse. The trigger pulse won't be produced if the comparator block is removed and hence won't trigger the monostable multivibrator.

Monostable Multivibrator: The trigger pulse from above block which represents the heart beat triggers the non retriggerable monostable multivibrator and produces a pulse around 200ms which is used to reject the noise pulse or artifact for that period.

Hence if non retriggerable monostable multivibrator block is removed false triggering will take place which will give an erroneous respiration rate.

b) Draw block diagram of pure tone audiometer and state the function of each block.

Ans :



Puretone Audiometer

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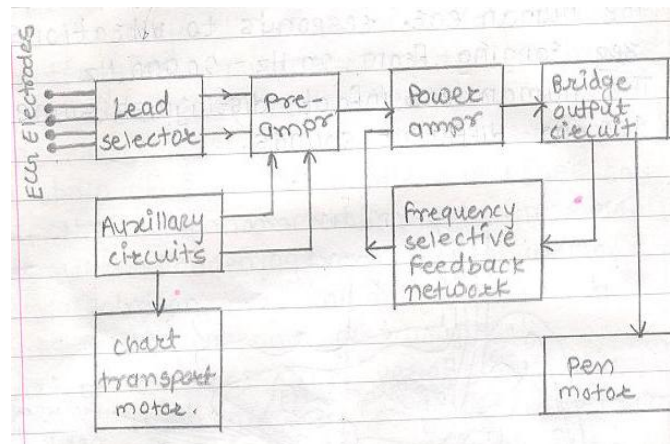
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A block diagram of pure tone audiometer is shown in fig. It consists of following block:

1. Tone generator
2. Noise generator
3. Tone amplifier
4. Noise amplifier
5. Tone attenuator
6. Masking attenuator
7. Output selector
8. Head phones
9. Bone vibrator
10. Microphone
11. Audio amplifier

Tone generator is a LC oscillator, which generates tone of frequencies between 125 Hz to 10 kHz in eleven steps. Noise generator is used to inject certain amount of noise or masking in another ear during measurement of air conduction threshold. This noise is wide band noise. Noise is generated usually by making use of semiconductor diode. Tone and noise amplifies amplify these signals to the desired level. A attenuator is usually rotary switch or electronically controlled up and down electronic switch. The output selector block switch either headphone or bone vibrator as per the test to be performed. It also helps to select the ears for testing and masking. Most of the headphones used in audiometer are dynamic type .Head phones and bone vibrators are used to measure air and bone conduction threshold respectively. Microphone and audio amplifier are employed to have a communication between operator and patient. Seven segment LED digital displays are used to continuously indicate the setting of frequency and tone & masking attenuators.

c) Draw block diagram of ECG machine and state the function of each block.
Ans:



ECG Machine

- Lead selector: It is used to select the appropriate lead configuration of electrode as per requirement of patient.
- Preamplifier: the lead picks the desired ECG signal it is amplified with the help of preamplifier which provides high gain. High sensitivity to the signal. It is electrically isolated from rest of the circuitry and earth by using either opto-coupler or transformer to protect the patient from leakage current. Bias for this amplifier is derived through DC to Dc converter.
- Recording mechanism of ECG machine consist of galvanometer, electrical motor, gear assembly, pinch roller, knife edge and recording stylus.

d) Describe generation of EMG.
Ans :

Generation of EMG signal: The contraction of the skeletal muscle results in the generation of action potentials in the individual muscle fibers, a record of which is known as electromyogram. In the skeletal muscle repolarization takes place much more rapidly as

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compare to cardiac muscle. Since most EMG measurements are made to obtain an indication of the amount of activity of a given muscle, or a group of muscles, rather than of an individual muscle fiber the EMG pattern is usually a summation of the individual action potentials from the fibers constituting the muscle or muscles being studied.

Q.4

B)
a)

Attempt any ONE :

An ECG machine is received with following problems. State remedies to eliminate it.

1. ECG trace too dark
2. ECG trace too light
3. ECG signal is noisy
4. ECG baseline is shifting
5. ECG trace not available
6. Machine not getting switched on.

Ans:(Any one remedy per fault) 1m each

1.ECG trace too dark

- Check thermal writing stylus adjustments which affect quality of tracing
- Check stylus pressure
- Check stylus heat control knob on front panel and set the knob by rotating it anticlockwise as it decreases the stylus heat.

2.ECG trace too light

- Check thermal writing stylus adjustments which affect quality of tracing
- Check stylus pressure and set pressure as recommended.
- Check stylus heat control knob on front panel (set the knob by rotating it clockwise as it increases the stylus heat)

3.ECG signal is noisy

- Preamplifier faulty (Replace preamplifier board or faulty components)
- Loose patient plug connection (Inspect and rectify)

4.ECG baseline is shifting

- Abrade skin
- Stop patient movement
- Check ground connections
- Use same type of electrode at all sites
- Check for proper cable
- Check for static build-up

5.ECG trace not available

- Check gain control for proper setting.
- Check brightness control for proper setting.
- Check lead selector switch. Make certain it is in the "on" position.
- Are the electrodes dry? If so, replace.
- Is the correct patient cable being used?
- Check the lead wires and cables for damage. Use a continuity tester.
- Check connections: a. Is the patient cable fully inserted into the monitor? b. Are the lead wires fully inserted into the patient cable? c. Are the lead wires securely attached to the electrodes?

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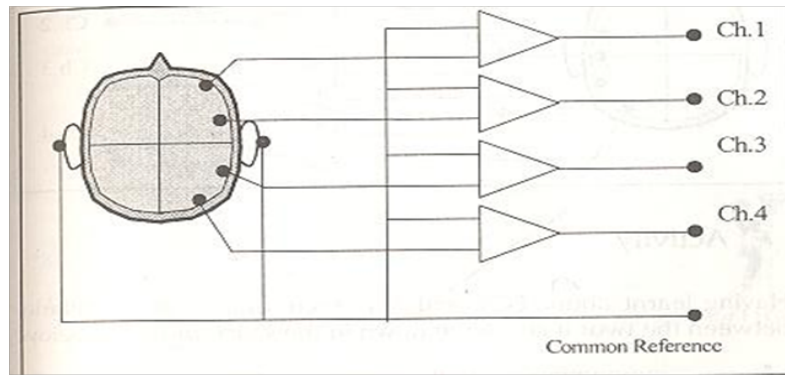
- Are the electrodes securely attached to the patient? Is additional skin prep necessary?
- Suggest that a technician check monitor function according to the manufacturer's specifications.

6. Machine not getting switched on

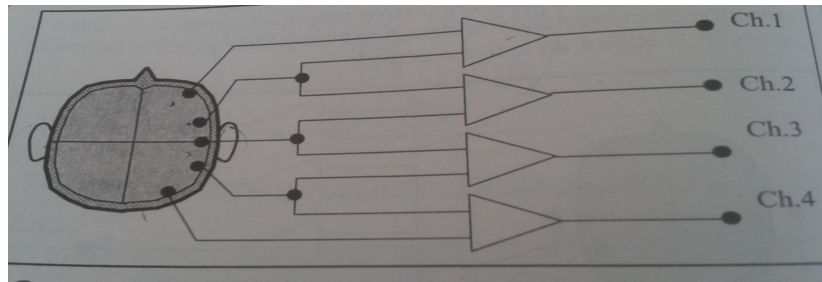
- No power from mains socket (Check power switch is on. Replace fuse with correct voltage and current rating if blown. Check mains power is present at socket using equipment known to be working.)
- Electrical cable fault (Contact electrician for rewiring if power not present. Try cable on another piece of equipment. Contact electrician for repair if required)

b) Draw unipolar, bipolar, and average electrode system for EEG recording.

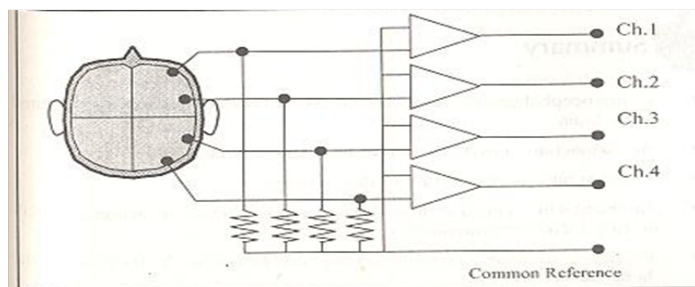
Ans:



Unipolar recording electrode system



Bipolar electrode system for EEG recording



Average electrode system for EEG recording

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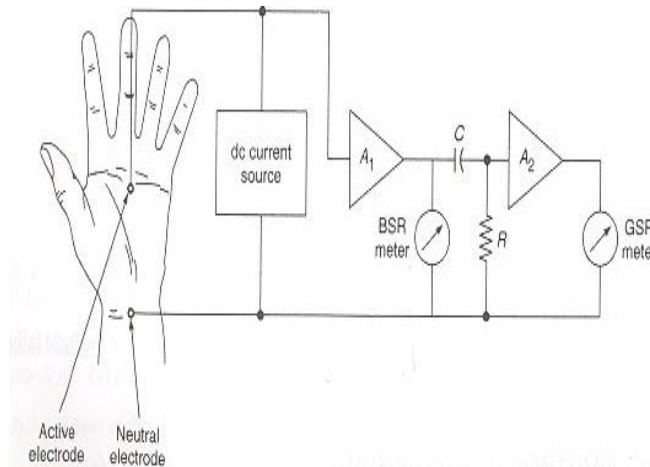
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Q5	a)	Attempt any four : List technical specifications of digital temperature indicator.(any four)	16
		Ans : Power : Battery 9v Measuring Range:0 to 42 deg c. Resolution :0.1 Accuracy: 0.1% Transducer: Semiconductor Display: 7 segment LCD	04

	b)	Describe spirometer with suitable diagram	02
		Ans : <p style="text-align: center;">Spirometer</p> <p>The conventional spirometer is as shown in fig. This instrument uses a bell suspended from above in the tank of water. An air hose leads from the mouth piece to the space inside of the bell above the water level. A weight is suspended from the top of the bell jar by a string that exactly balances the weight of the bell at atmospheric pressure. When no one is breathing into the mouth piece, the bell will be at rest with a fixed volume above the water level. But when the subject exhales, the pressure inside the bell increases above atmospheric pressure. The bell will rise. Similarly, when the patient inhales, the pressure inside the bell decreases, and the bell will drop. The change in bell pressure changes the volume inside the bell, which also causes the position of the counter weight to change. We may record the volume change on a piece of graph paper by attaching a pen to the counter weight or tension string. The chart recorder is a rotary drum model called a kymograph. It rotates slowly at a speed between 30 to 2000 mm/min. Some spirometers also offer an electrical output. Most frequently, the electrical output is generated by connecting a pen and weight assembly to a linear potentiometer. If precise positive and negative potentials are connected to the ends of the potentiometer, then the electrical signal will represent the same data as the pen. When no one is breathing into the mouth piece, E_o will be zero. When the patient breathes into the tube, it will take a value proportional to the volume and polarity that indicates inspiration or expiration.</p>	02

c) Draw block diagram of GSR meter and describe it.

Ans :



GSR meter

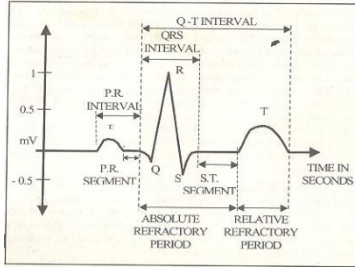
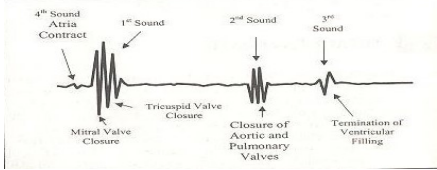
Galvanic skin response:- Galvanic skin response (GSR) is a method of measuring the electrical resistance of the skin. It is also known by many other names such as electro dermal response, psychogalvanic reflex (PGR) or skin conductance response (SCR). All these terms relate to one of more activities inside the sweat glands like a change in resistance and generation of potential. A decrease in the subject's resistance indicates arousal, whereas an increase in resistance is indicated as relaxation.

GSR measurement is normally performed by measuring a resistance change. This is done by detecting the change in impedance between two electrodes on the subject. Silver-silver chloride electrodes can be used to measure GSR. To make the measurement technique sensitive primarily to resistance change and also to avoid use of DC currents, very low frequency AC techniques are used in GSR measurement. A typical arrangement of electrode placement for GSR measurement is shown in the figure. GSR is due to the activity of the sweat glands. The BSR output is connected to an RC network with a time constant of 3 to 5 seconds, which enables the measurement of GSR as a change in skin resistance. In some cases, instead of the change in skin resistance, the change in skin potential is used. The range of potential changes is between 50mV and 70mV.

d) Compare ECG with PCG

Ans : (Any four)

ECG	PCG
ECG : Electro cardio graph	PCG : Phonocardiograph
It is the recording of electrical activity of heart functioning	It is the recording of the sounds connected with the pumping action of heart.
It is rhythmically repeating signal synchronize by heart function	These sounds provide an indication of heart rate and its rhythmicity.
The origin of ECG signal is SA node in the heart	The origin of PCG signal is pumping action of heart
It provides the recording of electrical	It provides a recording of wave forms of

	<p>activity in the form of PQRS waves.</p>	<p>heart sound.</p>	
	<p>Its output is in readable form</p>	<p>Its output is in audible form.</p>	
	<p>To Pick ECG signal surface type of electrodes are used</p>	<p>To Pick PCG signal dynamic microphone or contact sensor microphone can be used as a transducer,</p>	
	<div style="text-align: center;">  <p>ECG signal</p> </div>	<div style="text-align: center;">  <p>PCG signal</p> </div>	
<p>e)</p>	<p>Define any four respiratory parameters.</p> <p>Ans :</p> <p>1 Tidal Volume:- The volume of gas inspired or expired (exchanged with each breath) during normal quiet breathing is known as tidal volume.</p> <p>2 Minute Volume:- The volume of gas exchanged per minute during quiet breathing It is equal to the tidal volume multiplied by the breathing rate.</p> <p>3 Alveolar Ventilation :- (AV) The volume of fresh air entering the alveoli with each breath.</p> <p>4 Inspiratory Reserve volume: - The volume of gas which can be inspired from a normal. It is the maximum volume of air that can be inspired after normal inspiration It is about 3050ml</p> <p>5 Expiratory reserve volume:-The volume of gas remaining after a normal expiration less the volume remaining after a forced expiration.</p> <p>6 Residual Volume: - The volume of gas remaining in the lungs after a forced expiration.</p> <p>7 Functional Residual Capacity (FRC):- The volume of gas in the lungs after normal expiration.</p> <p>8 Total Lungs Capacity (TLC):-The volume of gas in the lungs at the point of maximal inspiration.</p> <p>9 Vital Capacity (VC):- The greatest volume that can be inspired from the resting end expiratory position.</p> <p>10 Inspiratory Capacity(IC):- The maximum volume that can be inspired from the resting end expiratory position.</p> <p>11 Dead Space:- Dead space is the functional volume of the lung that does not participate in gas exchange.</p>		<p>04</p>
<p>f)</p>	<p>Draw block diagram of EMG machine and state function of each block.</p> <p>Ans:.</p> <p>Power Supply Section: It produces a number of regulated voltages, which are used to supply analog and digital sections of the system</p>		

1. Stimulator Section:

It receives control signal from control section.

The control section generates trigger pulses at definite intervals to initiate operation of nerve and muscle stimulator and controls stimulus repetition rate.

2. Input Section:

The input section of the EMG equipment consists of electrode junction box, calibration network and pre-amplifier.

The EMG signals received from the patient are fed to the pre amplifier in electrode junction box. It is a buffer amplifier which has high input impedance, low noise and low output impedance.

A calibration network applies a rectangular voltage 100mV to the input of amplifier section when a calibration button is pressed to test the recorder and generate reference waveform.

3. Amplifier Section

It amplifies the signal to a desired level.

A multiple steps filter employed here allows only a signal of selected bandwidth to pass to next circuit i.e ADC in control section.

4. Control Section

It consists of central processing unit, keyboard memory, interfacing unit etc.

After processing the signal in control section, it is again converted to analog converter and fed to CRT.

5. Display section:

Normally CRT type displays are used with EMG machine. The display has two modes : Continuous and triggered.

The control section also generates two cursors on the CRT screen to perform measurements on the waveform.

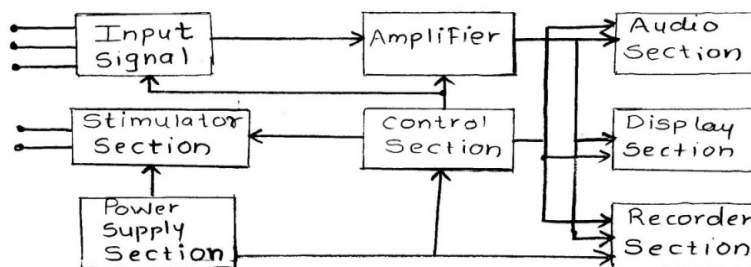
6. Recorder Section :

A power galvanometer with hot stylus is used as a recorder in EMG. In EMG system a low frequency signal is generated using a processor to suit frequency response of galvanometer and recorded.

7. Audio Section:

Being the EMG signals are in audible frequency range, an audio amplifier and speaker are incorporated in EMG machines.

Audio amplifiers of 2 to 7 watts are very commonly used in EMG machines.



EMG machine



<p>Q6) a)</p>	<p>Attempt any four : Write steps for maintenance of ECG machine. Ans :.(Any four steps) <u>Daily Maintenance</u> Cleaning: Wipe dust off exterior and cover equipment after checks. Remove any tape, paper or foreign body from equipment. Visual checks: Check all fittings and accessories are mounted correctly. Check there are no cracks in covers or liquid spillages. Function checks: If in use that day, run a brief function check before clinic. <u>Weekly Maintenance</u> Cleaning: Unplug, clean outside with damp cloth and dry off. Clean any filters or covers as directed by user manual. Visual checks: Tighten any loose screws and check parts are fitted tightly. Check mains plug screws are tight. Check mains cable has no bare wire and is not damaged. Function checks: Check any paper, oil, batteries etc. required are sufficient. Check all switches operate correctly. <u>Every six months</u> Biomedical Technician check required</p>	<p style="text-align: right;">16</p> <p style="text-align: right;">04</p>
<p>b)</p>	<p>List technical specifications of hearing aid. Ans: (any four) Power : Battery- 1.5v, AA type pencil cell in standard units Battery – Mercury (1.35v) or Silver oxide (1.5v) or Manganese(1.5v) in behind ears units. Electronics : solid state , IC based Frequency Response : 100Hz to 8000Hz Peak output: 130- 140 dB Gain :50 to 70 dB</p>	<p style="text-align: right;">04</p>
<p>c)</p>	<p>Describe the concept of systemic temperature and skin temperature. Ans: Two basic types of temperature measurements can be obtained from human body 1.Systemic temperature 2.Skin surface measurement <u>Systemic temperature</u> _ is temperature of internal regions of body. Body maintains systemic temperature as controlled balance between the heat generated by the active tissues and the heat lost by the body to the ambient. This temperature is constant throughout the body. Systemic temperature is accomplished by temperature sensing devices placed in mouth under armpits or in rectum (37 C healthy person).The under arm temperature is one degree lower, whereas the rectal temperature is one degree higher than mouth reading. <u>Skin or surface temp</u> – is function of surface circulation, environmental temperature & air circulating around the area (range 30– 35degree C).Thus is a balance between heat received and heat spent. Skin temperature can vary several degrees from one point to another point. The factors that affect the skin temperature are ambient temperature, covering of fat at capillaries of skin and blood circulation pattern at that point.Skintemp.measurements can be used to find defects in blood circulation system. Measurements can be made by small flat thermistor probes. Infrared thermometer can be used to measure the skin temperature.</p>	<p style="text-align: right;">02</p> <p style="text-align: right;">02</p>



<p>d)</p>	<p>Mention any four possible faults which can occur in EMG machine and give its solution to rectify it.(2m faults +2m solution) Ans :</p> <table border="1"> <thead> <tr> <th data-bbox="217 285 797 352">Faults</th> <th data-bbox="797 285 1373 352">Action(remedies)</th> </tr> </thead> <tbody> <tr> <td data-bbox="217 352 797 611">The Display Unit –Not a single light is on.</td> <td data-bbox="797 352 1373 611">There is no signal coming from the backpack. Check that the backpack is connected and the backpack DC OK light is on. If it is not ON then you probably have a broken coaxial cable — replace the cable with a spare and schedule the broken cable for repair as soon as possible</td> </tr> <tr> <td data-bbox="217 611 797 974">None of the front panel lights are on</td> <td data-bbox="797 611 1373 974">Check the line cord and fuse — at a minimum the green POWER light should be on to show that AC power is applied to the unit and the DC Power Supply is operational. Note that there are no user adjustments inside the desktop interface unit. The internal power supply is auto-sensing and will select the correct AC voltage range - no user adjustment is required.</td> </tr> <tr> <td data-bbox="217 974 797 1157">The system is functioning well but no EMG is recorded on any external device.</td> <td data-bbox="797 974 1373 1157">Check the connecting cable with an oscilloscope to ensure that the cable is correctly connected and that EMG signals are present at the input of the ADC sampling system.</td> </tr> <tr> <td data-bbox="217 1157 797 1373">Some EMG channels work but others do not have any EMG signals</td> <td data-bbox="797 1157 1373 1373">Check the analog signal connections from the back of the EMG machine desktop unit through to your measuring/recording system. 99% of all ‘lost signal’ complaints are due to problems with the analog signal cables and connectors.</td> </tr> </tbody> </table>	Faults	Action(remedies)	The Display Unit –Not a single light is on.	There is no signal coming from the backpack. Check that the backpack is connected and the backpack DC OK light is on. If it is not ON then you probably have a broken coaxial cable — replace the cable with a spare and schedule the broken cable for repair as soon as possible	None of the front panel lights are on	Check the line cord and fuse — at a minimum the green POWER light should be on to show that AC power is applied to the unit and the DC Power Supply is operational. Note that there are no user adjustments inside the desktop interface unit. The internal power supply is auto-sensing and will select the correct AC voltage range - no user adjustment is required.	The system is functioning well but no EMG is recorded on any external device.	Check the connecting cable with an oscilloscope to ensure that the cable is correctly connected and that EMG signals are present at the input of the ADC sampling system.	Some EMG channels work but others do not have any EMG signals	Check the analog signal connections from the back of the EMG machine desktop unit through to your measuring/recording system. 99% of all ‘lost signal’ complaints are due to problems with the analog signal cables and connectors.	<p>04</p>
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<p>e)</p>	<p>Describe the concept of impedance audiometer. Ans : The primary purpose of impedance audiometry is to determine the status of the tympanic membrane and middle ear via tympanometry. The secondary purpose of this test is to evaluate acoustic reflex pathways, which include cranial nerves (CN) VII and VIII and the auditory brainstem. This test cannot be used to directly assess auditory sensitivity, although results are interpreted in conjunction with other threshold measures. Acoustic immittance is a measurement of energy or air pressure flow, which involves the ear canal, eardrum, ossicular chain, tensor tympani, stapedius muscle, cochlea, CNs VII and VIII, and the brainstem. Mass, mobility, and resistance of the outer and middle ear systems affect this test. The reciprocal of acoustic immittance is acoustic impedance. Particularly in earlier years, these measurements were performed in impedance rather than immittance measures; thus, the term impedance audiometry is sometimes used.</p>	<p>04</p>										