



SYED AMMAL ENGINEERING COLLEGE



(Approved by the AICTE, New Delhi, Govt. of Tamilnadu and Affiliated to Anna University, Chennai)

Established in 1998 - An ISO 9001:2008 Certified Institution

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

TWO MARKS QUESTION BANK

UNIT I - ELECTRO-PHYSIOLOGY AND BIO-POTENTIAL RECORDING

THE ORIGIN OF BIO-POTENTIALS

1. Define

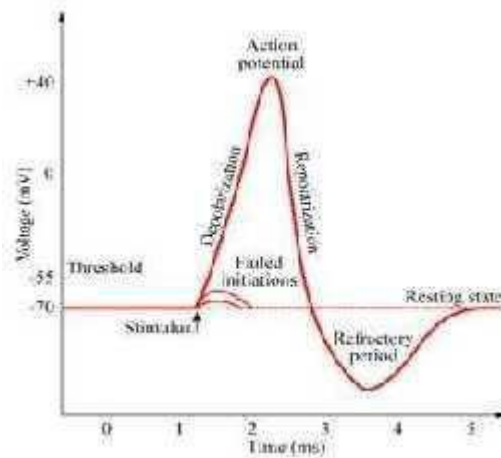
a) **Resting Potential**

b) **Action Potential**

May/June 2009, Nov/Dec 2008

Resting potential is defined as the electrical potential of an excitable cell relative to its surroundings when not stimulated or involved in passage of an impulse. It ranges from -60mV to -100mV

Action potential is defined as the change in electrical potential associated with the passage of an impulse along the membrane of a cell.



2. Define – Conduction Velocity

Apr/May 2008, Nov/Dec 2008, May/June 2007

Conduction velocity is defined as the rate at which an action potential moves down a fiber or is propagated from cell to cell. It is also called as Nerve conduction rate.



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3. Write down the Nernst equation of action potential.

An equation relating the potential across the membrane and the two concentrations of the ion is called Nernst equation.

$$E = \frac{RT}{nF} \ln \frac{C_1 f_1}{C_2 f_2}$$

Where,

R – gas constant (8.315×10^7 ergs/mole/degree Kelvin)

T – absolute Temperature, degrees Kelvin

n – valence of the ion (the number of electrons added or removed to ionize the atom)

F – Faraday constant (96,500 coulombs)

C_1, C_2 – two concentrations of the ion on the two sides of the membrane

f_1, f_2 – respective activity coefficients of the ion on the two sides of the membrane

4. What is meant by sodium pump?

Sodium pump is an active process in which sodium ions are quickly transported to the outside of the cell and the cell again becomes polarized and assumes its resting potential.

5. State all or none law in respect of cell bio potential.

Apr/May 2008

Regardless of the method by which a cell is excited or the intensity of the stimulus, the action potential is always the same for any given cell.

6. List the types of bioelectric potentials.

Bio electric potential related to

Heart – ElectroCardioGram (ECG)

Brain – ElectroEncephaloGram (EEG)

Muscle – ElectroMyoGram (EMG)

Eye (Retina) – ElectroRetinoGram (ERG)

Eye (Cornea – Retina) – ElectroOculoGram (EOG)

BIO-POTENTIAL ELECTRODES

7. Define electrode and list its types.

The device that convert ionic potential into electronic potential are called as electrode.

The types of electrode are

- Micro electrode
- Depth and needle electrode
- Surface electrode



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8. What are perfectly polarized and perfectly non polarized electrodes?

Electrodes in which no net transfer of charge occurs across the metal electrolyte interface is called perfectly polarized electrode.

Electrodes in which unhindered exchange of charge occurs across the metal electrolyte interface is called perfectly non polarized electrode.

9. What are the types of electrodes used in bipolar measurement? May/June- 2012

The types of electrodes used in bipolar measurement are

- Limb electrodes
- Floating Electrodes
- Skin electrodes

10. Name the electrodes used for recording EMG and ECG.

Nov/Dec-2012

Electrodes used for recording EMG are

- Needle electrodes
- Surface electrodes

Electrodes used for recording ECG are

- Limb electrodes
- Floating Electrodes
- Pregelged disposable electrodes
- Pasteless electrodes

BIOLOGICAL AMPLIFIERS

11. State the importance of biological amplifiers.

Apr/May 2010

Bio signals such as ECG, EMG, EEG, EOG have low amplitude and low frequency. So, amplifier is used to boost the amplitude level of bio signals.

12. What are the requirements for bio-amplifiers?

Bio amplifiers must have

- High input impedance
- Isolation and protection circuit
- High voltage gain
- Constant gain throughout required bandwidth
- Low output impedance
- High CMRR



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ECG, EEG, EMG, PCG, EOG LEAD SYSTEMS AND RECORDING METHODS, TYPICAL WAVEFORMS AND SIGNAL CHARACTERISTICS.

13. What are the basic components of biomedical systems?

The basic components are

- a) Patient
- b) Transducer
- c) Signal processing equipment
- d) Display
- e) Control unit
- f) Stimulus

14. List the lead systems used in ECG recording.

Apr/May 2010

The lead systems used in ECG recording are

- a) Bipolar Limb leads or Standard leads
- b) Augmented unipolar limb leads
- c) Chest leads or precordial leads

15. What is evoked potential?

The external stimuli are detected by the sense organs which cause changes in the electrical activity of the brain. Due to this, potential is developed in the brain as the response to external stimuli like light, sound etc. It is called as evoked potential.

16. What is PCG?

May/June- 2012, Nov/Dec -2012

A Phonocardiogram or PCG is a graphic display of the sounds generated by the heart and picked up by a microphone at the surface of the body. Frequency response required is 5 to 2000 Hz. It is measured by special transducer or microphone.



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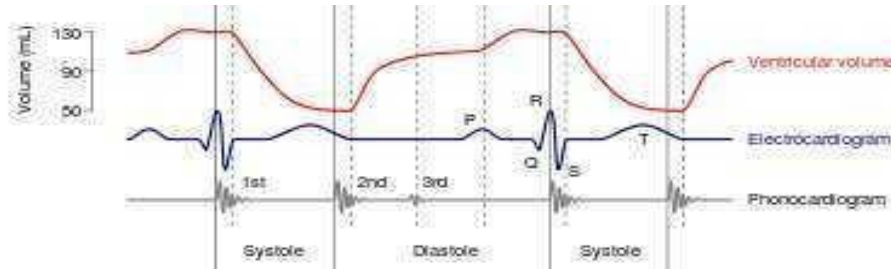
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17. Compare the signal characteristics of ECG and PCG. Nov/Dec-2011



ECG wave occurrence	PCG wave occurrence
QRS Complex	1 st heart sound
End of T wave	2 nd heart sound
Beginning of P wave	3 rd heart sound

18. What is EOG? Nov/Dec-2011

Nov/Dec-2011

Electrooculogram is the measure of the variations in the corneal – retinal potential as affected by the position and movement of eye. The EOG potentials are picked up by small surface electrodes placed on the skin near the eye.

19. State the importance of PCG signals. May/June 2009

May/June 2009

The importance of PCG signals are

- Different types of heart sounds are measured.
- Additional sounds are heard between normal heart sound due to vibration setup in the blood inside the heart by sudden closure of valves.
- The presence of higher frequencies (murmurs) in the phonocardiogram indicates a possible hear disorder such as Aortic stenosis, Mitral regurgitation, mitral stenosis etc.

20. Define latency as related to EMG. Nov/Dec 2008

Nov/Dec 2008

Latency is defined as the elapsed time between the stimulating impulse and the muscle action potential. In other words it is the time delay between stimulus and response



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21. Draw typical ECG waveform.

Nov/Dec 2009, May/June 2007

Wave	Amplitude (mV)	Duration (sec)
P	0.25	0.12 – 0.22 (P – R interval)
R	1.06	0.07 – 0.1
T	0.1 – 0.5	0.05 – 0.15 (S – T segment)
QRS Complex	-	0.09

22. What are the important bands of frequencies in EEG and state their importance.

Nov/Dec 2004

Waves	Frequency (Hz)	Observation
Delta(δ)	0.5 – 4	These wave occur in deep sleep in premature babies and in very serious organic brain disease.
Theta(θ)	4 – 8	These wave occurs during emotional stress in some adults particularly during disappointment and frustration
Alpha(α)	8 – 13	They found in the normal persons when they are awake in a quiet, resting state. During sleep they disappear.
Beta(β)	13- 22	It is observed when the person is alert active, busy, or anxious thinking, active concentration

23. What are the peak amplitude and frequency response for ECG, EEG and EMG.

Bioelectric potential	Function	Peak amplitude	Frequency response	Observation
ElectroCardioGram (ECG)	Records electrical activity of heart	0.1 to 4mV	0.05 to 120 Hz	Used to measure heart rate, arrhythmia and abnormalities
ElectroEncephaloGram (EEG)	Records electrical activity of brain	2 to 200 μ V	0.1 to 100 Hz	Used to analysis evoked potential, certain patterns, frequency response
ElectroMyoGram (EMG)	Records muscle potential	50 μ V to 1mV	5 to 2000 Hz	Used as indicator of muscle action for measuring fatigue



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UNIT II - BIO-CHEMICAL AND NON ELECTRICAL PARAMETER MEASUREMENTS

- 1. What are the typical values of blood pressure and pulse rate of an adult? (Nov/Dec.2012)**

Systolic (maximum) blood pressure in the normal adult is in the range of 95 to 145 mm Hg, with 120 mm Hg being average. Diastolic (lowest pressure between beats) blood pressure ranges from 60 to 90 mm Hg, 80 mm Hg being average.

- 2. What are systolic and diastolic pressures? (Nov/Dec 2011)**

The heart's pumping cycle is divided into two major parts systole and diastole. Systole is defined as the period of contraction of the heart muscles specifically the ventricular muscle at which time blood is pumped into the pulmonary artery and the aorta. Systolic pressure is 120 mm Hg (average value). Diastole is the period of dilation of the heart cavities as they fill with blood. Diastolic pressure is 80 mm Hg (average value).

- 3. What is the reason for decrease of cardiac output?**

The reason for decrease of cardiac output may be due to low blood pressure, reduced tissue oxygenation, poor renal function, shock and acidosis.

- 4. Define – Cardiac Output**

Cardiac output is defined as the amount of blood delivered by the heart to the aorta per minute. In case of adults during each beat, the amount of blood pumped ranges from 70 to 100 ml. for normal adults the cardiac output is about 4- 6 liters/ minute.

- 5. State the principle behind the indicator dilution method.**

The indicator dilution method is based on the principle that a known amount of dye or radio isotope as an indicator is introduced with respect to time at the measurement site, so the volume flow of blood can be estimated.

- 6. What is residual volume? (May /June 2007)**

Residual volume is the volume of gas remaining in the lungs at the end of maximum expiration.

- 7. Define – Tidal Volume**

Tidal volume is also called as normal depth volume of breathing or is the volume of gas inspired or expired during each normal quiet respiration cycle.

- 8. What is total lung capacity?**

The total lung capacity is the amount of gas contained in the lungs at the end of maximal inspiration.

- 9. Define – Vital Capacity**

The vital capacity (VC) is the maximum volume of gas that can be expelled from the lungs after a maximal inspiration.



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10. What is electrophoresis?

(April / May 2010)

Electrophoresis is a method for separating and analyzing macromolecular substances such as plasma proteins. The method is based on the fact that, the molecules carry electric charges and therefore migrate in a electric field.

11. How is cardiac output is used?

Using implanted electromagnetic fine probe on the aorta, find the cardiac output per minute directly can be found by multiplying the stroke volume with the heart beat rate per minute.

12. What are the uses of gas analyzers?

Gas analyzers are used to determine the quantitative composition of inspired and expired gas to assess the lung function.

13. What are the uses of blood flow meters?

Blood flow meters are used to monitor the blood flow in various blood vessels and to measure cardiac output. Flame photometer is used to analyze urine or blood in order to determine the concentration of potassium (K), sodium (Na), calcium (Ca) and lithium (Li).

15. What are blood cells?

The blood cells have important functions in our body. The red blood cell is used for the transport of oxygen and carbon dioxide. The white blood cells are part of the body's defense against infections and foreign substances. The platelet is involved in the clotting of blood.

16. What is the purpose PO₂ electrode is used?

PO₂ electrode is used to determine the oxygen tension in the blood. It is a piece of platinum wire embedded in an insulating glass holder with the end of wire exposed to the electrolyte into which the oxygen from the solution under measurement is allowed to diffuse through the membrane.

17. How is auto analyzer useful in medical field?

(April /May 2010)

Auto analyzer is used to measure blood chemistry and display that on a graphic recorder.

18. What are korotkoff sounds?

(Nov/Dec 2008)

In the Blood pressure (BP) measurement, when the systolic pressure exceeds the cuff pressure, then the doctor can hear some crashing, snapping sounds through the stethoscope. These sounds are called as korotkoff sounds.

19. What is cardiac output? What are the methods of measurement of cardiac output?

(Nov/ Dec 2004).

Cardiac output is the amount of blood delivered by the heart to the aorta per minute. For normal adult, the cardiac output is 4- 6 litres/min. The cardiac output is measured by



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using three methods. They are Fick’s Method, Indicator dilation method, Measurement of cardiac output by impedance change.

20. What are the two methods of pulse measurement?

The methods used for measuring pulse are transmittance and reflectance methods.

UNIT –III ASSIST DEVICES

1 Give two important factors that demand internal pace maker’s usage. [A/M2005]

The two important factors that demand internal pace maker’s usage are

- (i) Type and nature of the electrode used
- (ii) Nature of the cardiac problems.
- (iii) Mode of operation of the pacemaker system.

2 Classify Pacing modes[N/D 2007]

Based on the modes of operation of the pacemakers, they can be classified into five types. They are:

- i) Ventricular asynchronous pacemaker(fixed rate pacemaker)
- ii) Ventricular synchronous pacemaker
- iii) Ventri defibrillator inhibited pacemaker (demand pacemaker)
- iv) Atrial synchronous pacemaker
- v) Atrial sequential ventricular inhibited pacemaker

3 Distinguish between Internal and External pacemakers. [M/J 2007]

[N/D 2008]

S.No	Internal Pacemakers	External Pacemakers
1.	The pacemaker is a surgically implanted when if the skin near the chest or abdomen, with its output’s leads is connected directly to the heart muscle.	The pacemaker is placed outside the body in the form of wrist watch or in the pocket, from that one terminal will go in the heart through the vein
2.	It requires open chest minor surgery to place the pacemaker	It does not require open chest surgery
3.	It is used for temporary heart regularity	It is used for permanent heart regularity
4.	There is no safety for the pacemaker, particularly in case of child carrying the pacemaker	There is 100% safety for circuit from the external disturbances.



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4 What are the batteries used for implantable pacemaker?[N/D 2012]

The batteries used for implantable pacemakers are

(i)Mercury cell (ii) Lithium cells (iii) Nuclear cell

DC DEFIBRILLATOR

5 What types of electrodes are used in a defibrillator? [A/M 2005]

The electrodes used in a defibrillator are

(i)Internal electrodes - Spoon shaped

(ii)External electrodes -Paddle shaped

6 What are the three types of exchangers used in HEMODIALYSIS system? [M/J 2005]

The three types of exchangers used in HEMODIALYSIS systems

are i)Parallel Flow dialyzer

(ii)Coil Hemodialyser

(iii)Hollow Fiber Hemodialyser

7.What is meant by fibrillation?[M/J 2009][A/M 2010]

The condition at which the necessary synchronizing action of the heart is lost is known as fibrillation. During fibrillation the normal rhythmic contractions of either atria or the ventricles are replaced by rapid irregular twitching of the muscular wall

8 Calculate the energy stored in 16 μ F capacitor of a DC defibrillator that is charged to a potential of 5000 Vdc.

Given Data:

$$C = 16\mu\text{F}$$

$$V = 5000$$

$$E = (1/2) CV^2$$

$$= (1/2) \times 16 \times 10^{-6} \times 25 \times 10^6$$

$$= 200 \text{ Joules}$$



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UNIT IV PHYSICAL MEDICINE AND BIO-TELEMETRY/DIATHERMY

1. What is meant by diathermy? [A/M 2010]

Diathermy is the treatment process by which, cutting coagulation of tissues are obtained.

2. List the types of diathermy.

The types of diathermy are

- i) Short wave diathermy
- ii) Microwave diathermy
- iii) Ultrasonic diathermy
- iv) Surgical diathermy

3. What are the types of thermography?

The types of thermography are

- i). Infrared thermography
- ii) Liquid crystal thermography
- iii). Microwave thermography

4. What are the different types of current that are used for medical applications?

The different types of current are Threshold current, pain current, let-go current, paralysis current, fibrillation and defibrillation current.

5. Define - Endoscopes and mention some of its types.

Endoscope is a tubular optical instrument to inspect or view the body cavities which are not visible to the naked eye normally.

Types of endoscopes are cardioscope, bronchoscope, laparoscope, otoscope, gastroscope etc.

6. What are the devices used to protect against electrical hazards?

- i). Ground fault interrupt
- ii). Isolation transformer

7. What are the two methods of shortwave diathermy?

The two methods of shortwave diathermy

- are i) Capacitive method
- ii) Inductive method

8. What is the modulation techniques used for biotelemetry? Mention the reason for adopting that modulation scheme. [N/D 2004]

The two different modulation techniques used for biotelemetry

- are i) Double Modulation
- ii) Pulse Width Modulation



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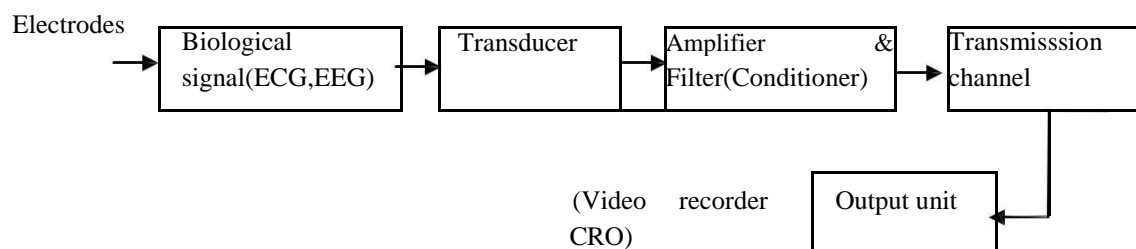
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The reason for adopting such a scheme

i) Double modulation gives

The purpose behind this **double modulation**, it gives better interference free performance in transmission, and this enables the reception of low frequency biological signals. The sub modulators can be a FM (frequency modulation) system, or a PWM (pulse width modulation) system or a final modulator is practically always an FM system.

9. Draw the block diagram of a Bio-Telemetry system. [N/D 2008]



10. What are the advantages of biotelemetry system? [M/J 2007] [M/J 2009]

The advantages of biotelemetry systems are

- (i) It is used to record the biosignals over long periods
- (ii) The medical attendant or computer can easily diagnose the nature of Disease by seeing the telemeter biosignals without attending patient Room
- (iii) Patient is not disturbed during recording
- (iv) For recording on animals, particularly for research, the biotelemetry is greatly used

11. Specify the frequencies used for biotelemetry.[N/D 2012]

Wireless telemetry system uses modulating systems for transmitting biomedical signals. Two modulators are used here. A lower frequency sub-carrier is employed in addition to very-high frequency (VHF). This transmits the signal from the transmitter.

RADIO-PILL AND TELE-STIMULATION

12. What is a radio-pill? [N/D 2009][A/M 2010][M/J 2012]

The radio pill is capable of measuring various parameters that are available in the tract. With the help of radio pill type devices, it is possible for us to measure or sense temperature, pH, enzyme activity and oxygen tension values. These measurements can be made in association with transducers. Pressure can be sensed by using variable inductance and temperature can be measured by using temperature-sensitive transducer.

13. What is the principle of telestimulation? [A/M 2008]

Telestimulation is the measurement of biological signals over long distance.



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UNIT-V RECENT TRENDS IN MEDICAL INSTRUMENTATION

1. What is medical thermography? Mention its applications. [N/D 2004] [N/D 2005]

Thermography is the process of recording true thermal image of the surfaces of objects under study. It displays images representing the thermal radiation of skin areas. Thermogram contain both qualitative and quantitative information relevant to the image itself and to temperature.

Medical applications of thermography

- i) Tumors
- ii) Inflammation
- iii) Diseases of peripheral vessels
- iv) Orthopedic diseases

2. List the types of lasers used in medical field [N/D 2004]

The types of lasers used in medical fields

- are i). Pulsed Nd-YaG laser
- ii). Continuous laser. Co₂ laser
- iii). Continuous wave organ ion laser

3. Define - Let-go current [M/J 2006] [A/M 2008]

Let – go current is the minimum current to produce muscular contraction. For men—about 16mA

For Women—about 10.5 mA

4. Define – Micro Shock[M/J 2007]

A physiological response to a current alied to the surface of the heart that results in unnecessary stimulation like muscle contractions or tissue injury is called as microshock.

5. What are the advantages of performing surgery using LASER? [A/M 2008][N/D 2009]

The advantages of performing surgery using LASER

- are i)Highly sterile
- ii) Non-contact surgery
- iii)Highly localized and precise
- iv)prompt surgery
- v) short period of surgical time



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6. Define – Macro Shock [N/D 2009]

A physiological response to a current applied to the surface of the body that produces unwanted stimulation like tissue injury or muscle contractions is called as macro shock.

7. What are the applications of laser in medicine?

Laser is used in ophthalmology (eye problem), Gynecology (fertility), Plastic surgery, skin cancer etc.

8. What is the purpose of using resuscitation unit?

Resuscitation unit is generally used in intensive care unit (ICU). In modern hospitals the resuscitation units are in the form of a mobile trolley.

9. List the applications of Endoscope.

Endoscopes are used in hospitals for examination, treatment of disease and surgery.

10. What is the use of laparoscope?

The laparoscope is used for analyzing abdominal related diseases and to perform operations in the abdominal region.