

**MARIA COLLEGE OF ENGINEERING AND TECHNOLOGY,
ATTOOR**
DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING
MEDICAL ELECTRONICS
2 MARK QUESTIONS & ANSWERS

**UNIT I
RECORDING AND MONITORING INSTRUMENTS**

1. What is the source of bioelectric signals?

The living tissues used as a power station generating multiple electrical signals with 2 internal sources namely muscles and nerves.

2. What are the basic bioelectrical signals parameter used and what are its frequency range?

- Electrocardiography (ECG) 0.05 to 120 Hz
- Electroencephalography (EEG) 0.1 to 100 Hz
- Electromyography (EMG) 5 to 2000 Hz

3. What is meant by ECG, EEG, and EMG?

- The recording of the electrical activity associated with the functioning of the heart is a electrocardiogram.
- The recording of the electrical activity associated with the functioning of the brain is a electroencephalogram.
- The recording of the electrical activity associated with the functioning of the skeletal muscles is an electromiogram.

4. What are the types of electrodes?

- Microelectrodes
- Depth and needle electrodes
- Surface electrodes.

5. What are the types of microelectrodes?

- Metallic microelectrode
- Nonmetallic or micropipet.

6. What are the needs of the electrodes?

- Electrodes makes a transfer from the ionic conduction in the tissue to the electronic conduction which is necessary for making measurement.
- Electrodes plays an important part in the satisfactory recording of bioelectric signals and their choice requires careful consideration.

7. Define VCG:

• Vectrocardiography is the technique of analyzing the electrical activity of the heart by obtaining ECG's along three axes at right angles to one another and displaying any two of these ECGs as a vector display on an

X,Y oscilloscope.

- This display is known as a vectorcardiogram.

8. Define PCG:

• The Phonocardiograph is an instrument used for recording the sounds connected with the pumping acton of the heart.

- These sounds provide an indication of the heart rate and its rhythmicity.

9. What are the origin of the heart sounds?

- The sounds are produced by the mechanical events that occur during the heart cycle.

- These sounds can be from the movement of the heart wall, closure of walls and turbulence and leakage of blood flow

10. What are the other biomedical recorders used in practice?

- Apex cardiograph
- Ballisto cardiograph
- Electro oculograph
- Electro retinograph

11. What is the advantage of silver-silver chloride electrode?

- These are found to yield acceptable standards of performance.
- These electrodes meet the demands of practice with the high reproducible parameters and superior properties with regard to long term stability.

12. What are the electrodes used for ECGs?

- Limb electrodes
- Floating electrodes
- Pregelled disposable electrodes
- Pasteless electrodes

13. What are the electrodes used for EEG and EMG?

- The Electrodes Used For EEG recording are the chloride silver discs.
- The electrode for EMG work are usually needle type. Needle types are used in clinical EMG, neurography and electrophysiological investigation of the muscle tissues.

14. What are the properties of the gel which are used in the pregelled disposable electrodes?

- Stay moist for intended shelf life and during use. This is controlled by including a humectants in the gel.
- Provide low electrolyte skin impedance by having ionic salts and surfactants.
- Cause minimum skin irritation, for which gels should have a PH range of 3.5 to 9.

15. What are the precautions should be taken to achieve good ECG display in the presence of electrosurgery interference?

- The electrosurgery return plates should be directly under the surgical site, as far as possible.
- The ECG electrodes should be placed at the maximum possible distance away from the surgical site.
- Only shielded ECG patient cables and electrodes leads must be used.

16. What are techniques used to calculate the heart rate?

- Average calculation.
- Beat to beat calculation.
- Combination of Beat to beat calculation with averaging.

17. State the types of microphones used for phonocardiograms?

- Contact microphones, Crystal microphones.
- Air microphones

b. dynamic microphones.

18. Define biofeedback:

It means for gaining control of the body processes to create a specially required physiological state so as to increase relaxation, relieve pain and develop healthier and more comfortable life patterns.

19. What are the objective of the biofeedback methods?

- Emotions or electrodermal activity.
- Muscle tension or EMG.

- Temperature or sympathetic pattern.
- Pulse.

20. What are effects of artefacts on ECG recording?

- Interference from the powerline.
- Shifting of the base line.
- Muscle tremor.

21. What is the need of ballistocardiograph?

- It is a machine that records the movement imparted to the body with each beat of the heart cycle.
- These movements occur during the ventricular contraction of the heart muscle when the blood is ejected with sufficient force.

22. What is the need of EOG?

- It is the recording of bio potentials generated by the movement of the eye ball.
- The EOG potentials are picked up by small surface electrodes placed on the skin near the eye.

23. What is the need of apexcardiograph?

- It records the chest-wall movements over the apex of the heart.
- These movements are in the form of vibrations having a frequency of about 0.1 to 20 Hz.

24. Define: Hysteresis

The changes of output with the same value of input but with a different history of input variation.

25. What is meant by Isolation?

Improper grounding of the system is one of the most common causes of measurement problems and noise. Signal conditioners with isolation can prevent these problems. Such devices pass the signal from its source to the measurement device without a physical or galvanic connection by using transformer, optical or capacitive coupling techniques.

26. What are the applications in the biomedical field of instrumentation amplifier?

- Extremely high input impedance
- Low bias and offset currents
- Less performance deterioration if source impedance changes
- Very high CMRR
- High slew rate
- Low power consumption

Unit II

MEASUREMENT AND ANALYSIS TECHNIQUE

1. What are the various types of blood flow meters?

- Electromagnetic blood flow meter.
- Ultrasonic blood flow meter
- NMR blood flow meter
- Laser Doppler blood flow meter.

2. Name the few physical principles based on which blood flow meters are worked?

- Faraday's law of electromagnetic induction.
- Doppler shift method
- Nuclear resonance method.

3. State the Faraday's law of electromagnetic induction:

When a conductor is moved through a magnetic field in a direction at right angles both to the magnetic field and its length an emf is induced in the conductor.

4. What are types of electromagnetic blood flow meters.

- Sine wave flow meters.
- Square wave flow meters.

5. How transformer voltage is induced in sine wave flow meters?

- In this the blood vessel and the fluid contained in it act as a secondary coil of a transformer when the probe magnet is excited.
- As a result in addition to the induced flow voltage there is an induced artifact voltage generally referred to as transformer voltage.

6. What is mean by invasive and non invasive methods?

- Invasive is the technique used for measuring the blood flow, heart rate, Blood pressure etc.. through surgical method.
- Non invasive is the technique used to measure the above through the external skin.

7. Define cardiac output measurement? Give the reason for decreasing the cardiac output?

- It is the quantity of blood delivered by the heart to the Aorta per minute.
- It is the major determination of oxygen delivery to the tissues.
- Due to the low blood pressure cardiac output is usually decreases.

8. What are the different types of methods used to measure the cardiac output?

- Indicator dilution technique
- Dye dilution technique
- Thermal dilution technique
- Impedance technique
- Ultra sound method.

9. What are the uses of pulmonary function analysers?

- These are used to evaluate the state of the lungs or the respiratory process.
- Clinically 3 basic types of measurements are performed which are ventilation, distribution and diffusion.

10. Define total lung capacity(TL);

- The volume of gas in the lungs at the maximal point of inspiration is a TL.
- Which is a sum of vital capacity(VC) and residual volume(RV)

11. Define Tidal Volume(TV) and vital capacity(VC)

- The volume of gas inspired or expired during normal quiet breathing, is known as tidal volume.
- It Is The maximum volume of gas that can be expelled from the lungs after a maximul inspiration.

12. Define Residual volume(RV):

- The volume of gas remaining in the lungs at the end of the maximul expiration is known as residual volume.

13. Define inspiratory capacity(IC):

- It is the maximum amount of gas inspired after reaching the end of expiratory level.

14. Define functional residual capacity(FRC):

It is the volume of gas remaining in the lungs at the of expiratory level.

15. Define spirometer

- The instrument used to measure the lung capacity and volume is called a spirometer.
- The record obtain from this device is called a spirogram.

16. What are the types of spirometers?

- Basic spirometers

- Wedge spirometers
 - Ultrasonic spirometers.
17. define pneumotachometers?
- These are the device used to measure the instantaneous rate of volume flow of expired gases.
 - 2 types—differential manometer and hot wire anemometer.
- 18.what are the uses of gas analysers?
- These are used to determine the quantitative composition of inspired and expired gases and to asses the lung function.
 - These are mostly based on infra red absorption of CO₂, paramagnetic behavior of oxygen, thermal conductivity of CO₂.
19. Define Blood Gas Analysers :
- These are used to measure the partial pressure of hydrogen , and carbon dioxoide and oxygen present in the human body.
20. What are the different types of pneumotachometers?
- Fleisch pneumotachometers.
 - Venturi Type pneumotachometers.
 - Turbine type pneumotachometers.
21. Define: Tidal volume.
- The volume of gas inspired or expired during normal quiet breathing is known as Tidal volume.
22. Define: Minute volume.
- The volume of gas exchanged per minute during quiet breathing. It is equal to the tidal volume multiplied by the breathing rate.
23. What are the types of tests under the single breath category?
- Tests that measure expired volume only
 - Tests that measure expired volume in a unit time
 - Tests that measure expired volume/Time.

UNIT III THERAPEUTIC EQUIPMENTS

1. Define pacemaker.
- Pacemaker is an electrical pulse generator for starting and maintaining the normal heart beat.
2. What are the basic types of pacemaker.
- External pacemaker.
 - Internal pacemaker or implantable pacemaker
3. State the difference between internal and external pacemaker.
- Internal pacemaker. External pacemaker.
- The pacemaker is placed outside of the body.it may be in the form of wrist watch from that one wire will go in to the heart through the vein.It is surgically implanted beneath the skin near the chest or abdomen with its output leads are connected directly to the heart muscle. It does not necessitate the open heart surgery It requires open heart surgery The battery can be easily replaced and any defect or adjustment in the circuit can be easily attended without getting any help from a medical doctor. The battery can be replaced only by the minor surgery and any defect or adjustment in the circuit cannot be easily attended .
4. State the types of implantable pacemaker.
- Fixed rate pacemaker.
 - Demand pacemaker.

- R wave triggered pacemaker.
 - Ventricular inhibited or R wave blocked pacemaker.
 - Atrial triggered pacemaker.
 - Dual chamber pacemaker.
5. What are the power sources of implantable pacemaker.

- Mercury batteries
- Biological power sources
- Nuclear batteries
- Lithium cells.

6. What do you mean by fibrillation.

- Fibrillation is a serious cardiac emergency resulting from asynchronous contraction of the heart muscle.
- Because of this irregular contraction the ventricles simply quiver rather than pumping the blood effectively.

7. Define defibrillator.

- Ventricular Fibrillation can be converted in to a more efficient rhythm by applying a high energy shock to the heart.
- This sudden surge across the heart causes all muscle fibers to contract simultaneously.
- This instrument for administering the shock is called as a defibrillator.

8. What are the types of defibrillator.

- DC defibrillator.
- DC defibrillator with synchronizer.
- Automatic or advisory external defibrillator.
- Implantable defibrillator.

9. Define surgical diathermy.

- surgical diathermy is the treatment process by which cutting, coagulation, etc. of tissues are obtained.
- It is found that when high frequency current in the range 1-3 MHz is applied.

10. Define fulguration.

- By passing a sparks from a needle electrode to the tissues the developed heat dries out the superficial tissue without affecting deep seated tissues.
- In which the electrode is held near the tissue without touching it and due to the passage of the electric arc the destruction of the tissue takes place.

11. Define desiccation.

The needle point electrode is stuck in to the tissue and kept steady while passing electric current.

12. Define electrotomy.

- When the electrode is kept above the skin, an electrical arc is sent.
- The developed heat produces a wedge shaped narrow cutting of the tissue on the surface.

13. What is hemostasis mode.

The concurrent use of continuous R.F current for cutting and coagulation is called hemostasis mode.

14. State the types of oxygenators.

- Bubble oxygenators.
- Film oxygenators.
- Membrane oxygenators.
- Liquid- liquid oxygenators.

15. Define heart lung machine.

- During open heart surgery for installation of a valve prosthesis or correction of a congenital mal formation ,the heart cannot maintain the circulation.
- It is then necessary to provide extra corporeal circulation with a special machine called heart lung machine.

16. State the difference between physiotherapy and electro therapy.

Physiotherapy is in the form of heat, either by simple heat radiation or by the application of high frequency energy obtained from special generators whereas the electro therapy employing a low-volt, low frequency impulse current.

17. What are all the methods used in physiotherapy treatment.

- Short wave diathermy
- Microwave diathermy
- Ultrasonic therapy unit.

18. Define dialysis.

It is a process by which the waste product in the blood are removed and restoration of normal PH value of the blood is obtained.

19. What are the types of dialyzers.

- Parallel flow dialyzers.
- Coil hemo dialyzers.
- Hollow fibre hemo dialyzers.

20. State the types of LASER.

- pulsed ruby laser
- ND-YAG laser
- Helium-neon laser
- Argon-ion laser
- Co2 laser
- Excimer laser

UNIT IV MEDICAL IMAGING

1. Write the principle behind on computer tomography.

- It is a new method of forming images from X rays .
- Measurements are taken from the transmitted X rays through the body and contain the information on all the constituents of the body in the path of the X ray beam.
- By using multidirectional scanning of the object, multiple data are collected.
- The mathematical basis for producing an image of the cross-sectional of these body can be obtained by computer.

2. What are the major system components of computer tomography?

- Scanning system
- Processing unit
- Viewing part
- Storage unit.

3. How X rays are generated?

- When the fast moving electron from the cathode enters in to the orbit of the anode material atom,its velocity is continuously decreased due to scattering by the orbiting electron.
- Thus the loss of energy of that incident electron appears in the form of continuous X rays.

4. State the difference between radiography and fluoroscopy

Radiography	Fluoroscopy
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X ray image is developed by photosensitive film X ray image is developed by photoelectric effect and fluorescence principle. A wide range of contrast can be obtained. Contrast can be increased by introducing electronic image intensifiers. Patient is not exposed to X rays during examinations of the X ray image Patient is exposed to X rays during examinations of the X ray image Patient dose is low Patient dose is high Movement of organs cannot be observed Movement of organs can be observed

5. What is the need of image intensifiers?

- Since some X rays are lost by means of bucky grid, the density of the image in the film will be reduced and the image resolution is also reduced.
- Therefore to improve the density and resolution of the image, the image intensifiers are used.

6. State the applications of X rays.

- Skeletal structure
- Respiratory organs
- Bronchial carcinoma
- Circulatory organ
- Digestive organs

7. State the applications of computer tomography

- Central nervous system
- Orthopedics and bone tumors
- Thorax
- Abdomen and pelvis
- Neck
- Radiotherapy and planning

8. What is meant by positron.

- Positron(β^+) is a positive electron which is an antiparticle of the electron.
- It has the energy charges of +1.

9. What are the needs of positron emission tomography.

- It is very useful in studying regional blood volume in transverse sections of the human brain and within the heart muscle

10. Write short notes on positron emission tomography

- In this technique a chemical compound with the desired biological activity is labeled with a radioactive isotope that decays by emitting a positron.
- The emitted positron combined with an electron and the two are mutually annihilated with the emission of 2 gamma rays.
- These gamma rays travel in opposite directions and penetrate the surrounding tissue and are recorded outside the subject by a circular array of detector.

11. Write about 2 design types of positron emission tomography

- One is employing opposed large area detectors which require rotation around the patient to provide the necessary degree of angular sampling.
- And the other one is employing multiple individual crystal detectors surrounding the patient in a circular or hexagonal array.

12. Define MRI and NMR.

- The magnetic resonance imaging (MRI) and nuclear magnetic resonance (NMR) uses a magnetic field and the radio frequencies to obtain the anatomical information about the human body as cross-sectional images in any direction and can easily discriminate between healthy and diseased tissues.

13. State the principle of NMR imaging system.

- When a material is placed in magnetic field some of the randomly oriented nuclei experience an external magnetic field which tends to align the individual parallel or anti-parallel magnetic moments to the

direction of an applied magnetic field.

- And this gives the tissue a net magnetic moment.

14. Define free induction decay signal (FID)

- At a room temperature there are more protons in a low energy state than in a high energy state.

- The excited protons tends to return or relax to its low-energy state with spontaneous decay and re emission of energy at a later time (t) in the form of radio wave photons.

- This decay is exponential in nature and produces a free induction decay signal.

15. State the image reconstruction techniques in NMR?

- Sequential Point Method

- Sequential line method

- Back projection zeugmatography

16. State the basic NMR components.

- A magnet

- An RF transmitter

- A gradient system

- A detection system

- An image system

17. What are the biological effects occur due to NMR components.

- Heating due to RF power.

- Static magnetic field

- Electric current induction due to rapid change in magnetic field.

18. What are the advantages of NMR imaging system.

- Cross sectional images with any orientation are possible in NMR imaging system.

- NMR uses no ionizing radiating and has minimal, if any hazards for operators of the machines and for the patients.

- It permits imaging of entire 3D volumes simultaneously instead of slice by slice, employed in other imaging system.

19. Define medical thermography

The medical thermograph is a sensitive infrared camera which presents a video image of the temperature distribution over the surface of the skin.

20. Define emissivity in NMR.

- It is defined as the ratio of the radiant energy emitted per unit area by an object to the radiant energy emitted per unit area of the black body at the same temperature.

21. State the requirements to have a good thermographic equipment?

- Short frame time

- High resolution

- A small size and light weight optical head

- An easy handling instrument in operation rooms

- Absolute temperature can be measurable.

22. State the application of medical thermography

- Healthy cases

- Tumors

- Inflammations

- Diseases of peripheral vessels

- Burns pernioles

- Orthopedic diseases
- Brain and nervous diseases
- Hormone diseases
- Organ transplantation

23. Define ultrasonography

- It is a technique by which ultrasonic energy is used to detect the state of the internal body organs
- Bursts of ultrasonic energy are transmitted from a piezoelectric or magnetostrictive transducer through the skin and into the internal anatomy.

24. State the limitations of ultrasound

- It cannot penetrate the gas and bones due to the acoustic impedance mismatch at the soft tissue-bone or soft tissue –gas interface.
- Hence bone lesions, lung lesion and intraluminal lesion cannot be evaluated.

UNIT V COMPUTER APPLICATION IN MEDICAL FIELD

1. What is the needs of wireless telemetry?

Wireless telemetry permits the examination of the physiological data of man or animal under normal condition and in natural surroundings without any discomfort or obstruction to the persons or animal under investigation.

2. State about the modulation system used in the wireless telemetry.

It uses for transmitting biological signals makes uses of 2 modulators.

- Frequency modulation.
- Pulse modulation.

3. What are the various forms of multiplexing wireless telemetry system?

- Frequency division multiplexing.
- Time division multiplexing.

4. What are the various forms of multichannel wireless telemetry system?

- Telemetry of respiratory and ECG
- Obstetrical Telemetry.
- Telemetry in operating rooms.
- Sports physiology studies through telemetry

5. Define telemedicine.

- It is the application of tele communications and computer technology to deliver health care from one location to other.
- It involves the use of modern information to deliver timely health service to those in need by the electronics transmission.

6. State the applications of telemedicine.

- Teleradiology.
- Tele cardiology.
- Tele education.
- Tele consultation.

7. What are the essential parameters of telemedicine.

- Primary patient data.
- Patient history.
- Clinical information.
- Investigations

- Data and reports.

8. State the telemedicine concepts.

- Store and forward concept

- Real time concept

9. What is meant by Store and forward concept.

It involves compilation and storing of information relating to audio, video and clips, ECG, etc,...

10. What is meant by Real time concepts.

It involves the real time exchange of information between the two centres simultaneously and communication interactively.

11. Define arrhythmia.

- Any disturbances in the heart's normal rhythmic contraction is called arrhythmia.

- Patients undergoing uneventful recovery from myocardial infarction may develop cardiac arrest and immediate result of cardiac defibrillation.

12. What are the diagnostic statements observed from the ECG records.

- Morphological statement – based on ECG waveshapes.

- Rhythm statement- concerned with the site and the rate of cardiac pacemaker.

13. Write short notes on arrhythmia monitor.

- It is an alarm system.

- It is not an ECG interpretation system.

- Constantly scans ECG rhythm pattern and issues alarm to events that may be premonitory or life threatening.

14. What are the major systems consist in arrhythmia monitor.

- Signal conditioning block

- Noise detection.

- QRS detection

- Morphology characterization.

- Timing classification.

- Beat labeling.

- Rhythm labeling.

- Atrial fibrillation detection.

- Ventricular fibrillation.

- Alarms.

15. Write short notes on e-Health.

It is a relatively recent term for health care practice which is supported by electronic process and communication.

16. What is meant by transducer?

The device convert one form of energy to another form of energy is called transducer.

17. Define: Radio Telemetry systems

Most biotelemetry systems are involved with radio transmission and reception of biosignals. There are single channel and multichannel telemetry system.

18. What is meant by transmission of bioelectric variables?

In a single channel telemetry system the measurements are made under any of two categories:

- Active measurements

- Passive measurements.

19. Define: Macroshock

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

20. Define: Microshock

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

21. List out the advantage of laser surgery

- Highly sterile
- Highly located and precise
- Non contact surgery
- Short period of surgical time.
- More advantageous for children since it is a painless surgery.

22. Define: Specular reflection.

Specular reflection occurs when the interface is larger than the sound beam. The angle of reflection is equal to angle of incidence. Example: Capsule of liver, Kidney, Aorta and Gallbladder.

23. Define: Non-Specular reflection.

Non-Specular reflection occurs when the interface is smaller than the sound beam. Example: Parenchymal tissue echoes such as those arising between cells and small vessels.

16 MARK QUESTIONS

1 Explain about the generation of bio-potential?

2 Describe the method applied to study about the activity of brain centre for vision and highlight the method of processing the signal?

3 Write about the blood cell counter working on the principle of conductivity. What are the problems associated with this method?

4 What is an autoanalyser? Explain.

5 What do you mean by cardiac output? Explain the principle of dye dilution technique for the measurement of the same.

6 Describe in detail, the electromagnetic blood flow meter. What are its advantages and how are they overcome.

7 What is atrial fibrillation? How is it arrested? Explain what are the precautions to be followed when this equipment is used?

8 Explain the operation of pacemaker working on demand. Compare its performance with the triggered type.

9 Write briefly about radio pill.

10 What is diathermy? Discuss about ultrasound diathermy? How is the frequency of operation selected for this type?

11 How are the muscles and nerves stimulated by electronic means? Explain the complete set up of a medical stimulator.

12 Explain about the imaging method applied to study about the peripheral circulation? What are its other applications?

13 How can a high frequency generator be used as a surgical knife? Explain.

14 Write about the terms “microshock” and “macroshock” hazards.