UNIT-I
ELECTRO-PHYSIOLOGY AND BIO-POTENTIAL RECORDING

PART – A (2 Marks)
1. What are the objectives of a biomedical instrumentation system?
2. Define the term conduction velocity.
3. Explain the difference between in vivo and in vitro measurements.
4. Name the major physiological systems of the body.
5. What is meant by cell?
6. What are resting and action potential, bioelectric potential?
7. Define the process of sodium pump.
8. Draw an action potential waveform and label the amplitudes and time values.
9. What specific features might be incorporated into an instrument designed for clinical use as opposed to one designed for research purposes?
10. What do you understand by the term "gage factor"?
11. What is the difference between an active and a passive transducer?
12. What are the characteristics of carrier amplifier?
13. What is meant by drift compensation in operational amplifiers?
14. Define an electrometer amplifier. What are its characteristics?
15. What is the purpose of pre-amplifier isolation circuits in ECG circuit?
16. What is the purpose of auxiliary amplifier in ECG unit?
17. What is input isolation?
18. What is the function of chopper amplifier?
19. Define Lead. Name the types of leads used for ECG.
20. What are micro, needle and surface electrodes?
21. Define electrode, what are the types of electrodes.
22. What is electrode potential (or) half-cell potential? What are polarisable and non polarisable electrodes?
23. What are the characteristics of resting potential?
24. For a patient, which types of electrode would be the least traumatic?
25. Why microelectrodes are sometimes needed?
26. What are the problems involved in using flat electrodes in terms of interference or high impedance between electrode and skin? How could you help eliminate this problem? / What are the uses of the electrode paste applied during biomedical recording?
27. What do you understand by the term "reference electrode"?
28. What is a glass electrode used for?
29. What is an ear-clip electrode used for?
30. What is the major advantage of floating-type skin surface electrodes?  
31. What is the hydrogen ion concentration of blood with a pH of 7.4?  
32. What are parts of central nervous system?  
33. Name the parts that contain peripheral nervous system.  
34. Define circulatory system.  
35. Define Einthoven triangle.  
36. What is electro encephalography?  
37. What is evoked potential?  
38. What is meant by brain waves and what are the types of brain waves?  
39. Draw the waves of brain.  
40. What is electromyography?  
41. How would you state the sensitivity characteristics of an electrocardiograph to give a 2-in. deflection on a recorder for a 2-mV peak reading?  
42. What is the difference in the information contained in a phonocardiogram and an electrocardiogram?  
43. If a person stands up, does his blood pressure increase? Why?  
44. If a person eats a large meal, does his heart rate increase? Why?  
45. What part of the cardiovascular system contains the greatest volume of blood?  
46. What is meant by ‘Depolarization’?  
47. What is ‘Absolute Refractory Period’?

**PART – B**

1. Explain the factors that influence the design and application of a medical instruction system / Discuss the different characteristics of a medical instrument system. (8)  
2. Explain the man-instrument system with a neat block diagram / Explain with a block diagram the components of the bio-medical instrument system. (8)  
3. Discuss the problems encountered in measuring a living system / Discuss the major differences encountered between measurements in a physiological system as distinct from a physical system. (8)  
4. Draw the structure of a living cell of our body and explain its constituents. (8)  
5. Discuss the different ways of transport of ions through the cell membrane (4)  
6. Give an account on the different chemical compositions in the intra and extra cellular fluids and their effects in the case of blood serum. (4)  
7. Discuss the development of action potential and muscular contraction. (8)  
8. Draw the electrical equivalent circuit of microelectrode and explain its electrical nature. (8)  
9. What are biopotential electrodes. Distinguish between metallic microelectrode and nonmetallic microelectrode. (4)  
10. Draw the micropipette nonmetallic electrode and explain (8)  
11. With a neat block diagram, explain the working of ECG recorder (8)  
12. Discuss the different lead configuration used in ECG. (8)
13. Explain with a neat diagram the resting potential (8)
14. Explain polarization, depolarization the depolarization (8)
15. Draw the circuit diagram of an ECG isolation amplifier and explain its action. (8)
16. What are chopper amplifiers and explain. (8)
17. Explain with a diagram medical preamplifier and explain its action (8)
18. Explain a bridge voltage amplifier and explain (8)
19. Explain buffer amplifier and explain (8)
20. Explain a current amplifier circuit and explain its working. (8)
21. Draw the curves of ECG and diagnose any form of disturbance in heart rhythm (8)
22. Draw the block diagram of an EEG unit and explain the different parts in it. (8)
23. Give the origin of brain waves and describe the 10-20 electrode system used in EEG. (8)
24. Describe the recording setup used in EMG (8)
25. Write a note on ERG and EOG (8)
26. Explain the origin of different heart sounds (8)
27. Explain with diagram the salient features of Phonocardiography (PCG) (8)
28. Draw the frequency response of
   a. An electromyogram. (2)
   b. Blood flow measurements. (2)
   c. Phonocardiogram. (2)
   d. Plethysmogram (2)
29. (a) Write down the ‘Nernst Equation’ and ‘Goldman Equation’ and explain about the constants used. (8)
   (b) Explain ‘Bio Electric Potentials from the brain’ and ‘Resting Rhythms of the Brain’. (8)

UNIT- II
BIO-CHEMICAL AND NON ELECTRICAL PARAMETER MEASUREMENT

PART – A( 2 Marks)

1. Define heart, lung.
2. Define cardiac output. Give the reason for decrease of cardiac output.
3. State the principle behind the indicator dilution method.
4. Draw the dilution curve.
5. What is phonocardiography? Give its important application.
6. Define systole and diastole.
7. How the blood pressure is measured by ultrasonic method. (Diastolic, systolic)?
8. What is electromagnetic blood flow meter & define the principle based on it?
10. Motion artifact refers to what? What is its cause?
11. What is diffusion?
12. Define Gas chromatograph.
13. What is meant by Gas analysis and what are the types of Gas analyzers used?
14. Define Diffusing capacity, what is the range in normal adults.
15. Define heart sound and murmurs, regurgitation.
17. Define residual volume.
18. What is meant by total lung capacity?
19. What is vital capacity?
20. What is GSR?
21. What is the necessary of heart lung machine? (2 Marks)
22. Why the impedance plethysmograph is sometimes called a pseudo-plethysmograph?
23. What is meant by mean arterial pressure? How do you measure it?
24. What is the difference between a single-lumen catheter and a multiple-lumen "floatation"catheter?
25. What are the relative merits of dyes and cold saline methods in cardiac output measurements?
26. What do you understand by the term "noninvasive methods"?
27. Why is skin surface temperature lower than systemic temperature measured orally?
28. What are the important characteristics to be considered in selecting a thermistor probe for a specific medical application?
29. What is meant by Doppler Effect?
30. What is a neuronal spike? Draw a typical spike showing amplitude and duration.
31. Draw a sketch of a neuron and label the cell body, dendrite, axon and axonhillock.
32. What are graded potentials?
33. What is a spinal reflex, and how is it related to the functions of the brain?
34. List the most important components of the blood.
35. List the main types of blood tests and explain each briefly.
36. What do you understand by the term "blood count"?
37. Define "coincidence error" in blood cell counters.
38. Calculate the cardiac output for a patient with a heart rate of 72 beats/minute and stroke volume of 75 ml/beat.
39. Name any four physical principles based on which blood flow meters are constructed.
40. What are plethysmographs and plethysmography?
PART -B

1. What is meant by vector cardiograph and how it is accomplished? (4)
2. In the case of ultrasonic blood flowmeter, using transit time method, the timer in that flowmeter gives the difference between upstream and downstream transit times as 1.7 nanoseconds and the angle between the direction of the flow and the central axis of the ultrasonic beam is about 15°. The perpendicular distance between the transmitting and receiving transducers situate in the blood vessel is about 2 cm. The ultrasonic velocity in blood is 1500 m/s. Calculate the velocity of the blood flow in that vessel. (4)
3. In the case of indicator dilution method for the cardiac output measurement, 10 mg of indicator dye is injected. The area under the dilution curve is found to be 150 mgs/litre. Calculate the cardiac output per minute. (4)
4. In the body plethysmograph, the volume of the chamber is 0.20 m³. The max. thorax pressure is 2 \cdot 10^5 Pascals and its minimum is 0.35 \cdot 10^5 Pascals when the patient goes through breathing motions after the mouthpiece valve is closed. Meanwhile the chamber pressure goes from 0.97 \cdot 10^5 Pascals to 1.03 \cdot 10^5 Pascals. Calculate the total lung capacity. (4)
5. Calculate the velocity of the blood flow in a blood vessel using the following data. The velocity of ultrasonic waves in blood is 1500 m/s. The angle between direction of the blood flow and direction of incident ultrasonic beam is about 30°. The Doppler shift in frequency is about 231Hz when the incident ultrasonic frequency is 2 MHz. (4)
6. Explain the following electrodes with neat diagram
   (i) Hydrogen (8)
   (ii) pH (8)
7. Explain the following electrodes with neat diagram
   (i) Pco₂ (8)
   (ii) Po₂ (8)
8. What are biomedical electrodes? Explain the electrode P_{HCO₃} with neat diagram. (8)
9. Draw the block diagram of an automatic blood cell counter and explain its functioning. (8)
10. Describe the principle of laser based blood cell counting using a schematic diagram. (8)
11. Explain the working principle of spectrophotometer. (8)
12. Explain the principle of chromatography and its applications in medicine. (8)
13. Discuss the principle and working of electromagnetic blood flow meters. (8)
14. Describe an ultrasonic blood flow meter used in the measurement of velocity of blood flowing in the blood vessels. (8)
15. Describe ultrasonic Doppler blood flow meters. (16)
18. Explain with a block diagram the laser based blood flow meter. (8)
19. Explain the Fick’s method for the determination of cardiac output. (8)
20. Explain the Indicator dilution method of cardiac output measurement. (8)
21. Explain the thermo dilution method of cardiac output measurement. (8)
22. Describe a method for the measurement of total lung capacity./ Describe the plethysmograph method of measuring the total lung capacity. (8)
23. Describe a spirometer with a suitable schematic diagram. (8)
24. Explain in detail any one of the methods used for measuring blood pressure (8)
25. Explain in detail any one of the methods used for measuring temperature (8)
26. What is pneumotachograph? Give its importance in the pulmonary function analysis. (8)
27. Write down the application of Electrophoresis and explain the basic principle involved (8)

UNIT – III
ASSIST DEVICES AND BIO-TELEMETRY

PART – A (2 Marks)
1. Define artifact.
2. Define Biotelemetry.
3. What are the uses of biotelemetry?
4. Briefly mention the different elements involved in the biotelemetry.
5. What is meant by single channel telemetry system?
6. Distinguish between frequency division multiplex system and time division multiplex system used in the transmission of biosignals.
7. What are the problems associated with the implant telemetry circuits?
8. List the advantages and disadvantages of biotelemetry.
9. What is telestimulator?
10. Give the advantages of laser surgery and medical applications of lasers.
11. Define cardiac pacemaker.
12. Calculate the energy stored in a 16 microFarad capacitor of a defibrillator that is charged to a potential of 5000 V dc.
13. How the pacemaker is classified depending upon the modes of operation.
14. What is a "demand" pacemaker and when is it used?
15. What is meant by defibrillator & what are the types based on that?
16. What do you understand by fibrillation? How do you correct for it?
17. Give the difference between external and internal defibrillator.
18. What is the necessity of D.C.defibrillator?
19. What equipment would you need in a diagnostic catheterization laboratory?
20. How many lobes are there in the lungs?
21. A person has a total lung capacity of 5.95 liters. If the volume of air in the lungs at the end of maximal expiration is 1.19 liters, what is his vital capacity?
22. Since the lungs contain no musculature, what causes them to expand and contract in breathing?
23. For what measurements can a spirometer be used? What basic lung volumes and capacities cannot be measured with a spirometer? Why?
24. What are medical transmitting frequencies? Why is it necessary to specify them?
25. What are the advantages of rectangular wave defibrillator?
26. What is meant by radiopill?

**PART – B**

1. Describe the cardiac pacemaker waveforms and explain their importance. Compare external and implanted pacemakers. (8)
2. Explain with a diagram the ventricular asynchronous pacemaker (fixed rate pacemaker). (8)
3. Explain the ventricular synchronous pacemaker. (8)
4. Explain working principle of demand pacemaker with a diagram. (8)
5. Explain the atrial synchronous pacemaker. (8)
6. Explain with a neat diagram, the working principle of D.C. defibrillator. (8)
7. Explain with a neat diagram, the working principle of synchronized D.C. defibrillator. (8)
8. Explain the square pulse defibrillator. (8)
9. Explain the block diagram of a bio-telemetry system. Discuss its design. (8)
10. Explain the single channel telemetry system. (8)
11. Draw and explain the telemetry circuit for the transmission of EMG, ECG, EEG and respiration rate. (16)
12. Explain the subcarrier biotelemetry system. (8)
13. Explain the multiple channel telemetry systems with neat diagrams. (16)
14. What are the problems associated with the implant telemetry circuits? Explain the uses of biotelemetry. (8)
15. Explain the various modulation techniques used for transmitting a biosignal in a telemetry system (8)
16. Write short notes on telestimulation (8)
17. What are the precautions to be followed in hospitals while using defibrillators (4)
18. Write briefly about the power sources used for implantable type of pacemaker (8)
19. What is radiopill? Explain. (8)
20. Write technical properties of electrodes used in Defibrillator (4)
21. Write short notes on ‘Frequency Selection’ w.r.t. Biotelemetry (8)
22. Explain the basic concepts (including the modulation types) of radio transmission used in biotelemetry (16)
UNIT – IV
RADIOLOGICAL EQUIPMENTS

PART – A (2 Marks)
1. What are the components of diagnostic x-ray machine?
2. How X-rays are produced?
3. Why is the use of radioisotopes for in vivo methods limited to those isotopes that emit gamma radiation?
4. Mention the different applications of X-ray examination.
5. Define radiation therapy.
6. Name any two equipments used in radiation therapy.
7. What is meant by half-life in radioisotopes?
8. What is an ionization chamber?
9. What is a spark chamber?
10. Name any four radioisotopes used for medical purposes.
12. What is the significance of Bucky diaphragm (Grid).
13. Differentiate between radiography and fluoroscopy.
14. What is cardiac catheterization technique?
15. Define MRI.

PART – B
1. Discuss in detail the radiation therapy techniques. (8)
2. Explain with suitable diagram the diagnostic X–Ray machine. What are the applications of X-Ray examination? (16)
3. Explain with suitable diagrams the working principle of the two types of scintillation detectors for gamma radiation. (8)
4. With a block diagram, explain the instrumentation system for radioisotope procedures. (8)
5. Write short notes on the following detectors for beta radiation:
   (a) Gas flow counter (4)
   (b) Liquid scintillation counter (4)
6. Draw the schematic diagram of a G.M. counter and explain its working details. (8)
7. Explain the following radiation detectors.
   (a) Expansion type cloud chamber (4)
   (b) Diffusion type cloud chamber (4)
   (c) Bubble chamber (4)
   (d) Scintillation counters (4)
8. Describe the principle of visualizing body organs by radioisotope methods. (8)
9. List out the properties of X-Rays (4)
10. Write short notes on angiography (4)
11. Explain the working principle of image intensifier with a neat block diagram (8)
12. Write short notes on ionization chamber (8)
13. Discuss about intensity duration curve. What is its use? (8)
PART – A (2 Marks)
1. Define an electric shock hazard.
2. Define macro shock, micro shock.
3. Explain the term diathermy and what are its types.
4. Define fulguration.
5. Define coagulation.
6. Define Blending.
7. List out the properties of LASER
8. Name two different ways in which electricity can harm the body.
9. List the various effects of electrical current that occur with increasing current intensity.
10. What is the difference between electrical macroshock and microshock? In what parts of the hospital are microshock hazards likely to exist?
11. What is the basic purpose of the safety measures used with electrically susceptible patients?
12. Why is it so important to maintain the integrity of the grounding system for protection against microshock?

PART – B
1. Explain with block diagram the infrared thermograph technique and its merits and demerits. (8)
2. What are the medical applications of thermography (8)
3. Mention the details of laser instrumentation for biomedical applications. (8)
4. Discuss the laser principle and mention the different laser interactions on our body. (8)
5. Write short notes on HE-NE laser and the general applications of laser in medicine (8)
6. What are the uses of endoscopes in medicine? Describe any one of the therapeutic instrument using an endoscope. (8)
7. What are the different types of commonly available endoscopes and their diagnostic applications? (4)
8. Explain the liquid crystal thermograph in brief. (4)
9. What are the techniques involved in electro surgery techniques using diathermy units? (8)
10. Draw the block diagram of short wave diathermy unit and explain. (8)
11. Draw the block diagram of ultrasonic diathermy. (8)
12. Explain in brief the salient features of microwave diathermy. (4)
13. Discuss the range and area of irritation of different heating techniques in diathermy. (4)
14. Give an account on biological effects of radiation exposure and safe dose equivalent limits. (8)
15. Describe the construction and working of any one of the personnel radiation monitoring equipment (8)
16. Write a note on area monitoring in the case of radiation safety. (8)
17. Explain the physiological effects of current at commercial frequencies on human body (8)
18. Describe the possibilities of occurrence of micro shock hazards in a hospital. (16)
19. Explain the following with respect to ‘electrical safety’: (a) Ground fault interrupter (3)
   (b) Isolation transformer (3)
   (c) Line isolation monitors (3)
   (d) Grounding (3)
   (e) Important aspects of hospital architecture. (4)
20. Bring out the salient points of instrumentation in
   (a) Endoscopy unit (8)
   (b) Bio Medical Laser (8)