Name:

Enrolment No:

UPES

End Semester Examination, May 2025

Course : Medical Physics & Biomedical Instrumentation **Semester : IV**

Program : B.Tech - Biomedical Engineering **Duration : 3 Hours**

Course Code: HSBE2008 **Max. Marks: 100**

Instructions: All questions are compulsory.

Please read the questions carefully. The paper contains four sections.

S. No.	Section A Short answer questions/ MCQ/T&F (20Qx1.5M= 30 Marks)	Marks	COs
Q 1	True or False: Glass micro-capillaries are a type of micro electrode."	1.5	CO1
Q 2	To measure ECG, usually how many electrodes are connected to a patient? a. One b. Two c. Three d. Four	1.5	CO1
Q 3	The basic functional unit of the nervous system is _____ a. Nerves b. Axon c. Neuron d. Dendrite	1.5	CO1
Q 4	Which type of transducer requires energy to be put into it to translate changes due to the measurand? a. active transducers b. passive transducers c. powered transducers d. local transducers	1.5	CO1
Q 5	The ability of the sensor to see small differences in reading is called _____ a. resolution b. drift c. offset d. linearity	1.5	CO1
Q 6	Process of changing resting potential to action potential is known as a. Polarization b. Repolarization c. Depolarization d. Unipolarization	1.5	CO1

Q 7	Electroencephalogram (EEG) rhythm was first recorded by: a. William Einthovan b. Egas Moniz c. Hans Berger d. Gaillard L	1.5	CO1
Q 8	Write the formula for impedance in the RC circuit.	1.5	CO1
Q 9	True or false: "In floating electrodes metal electrode does not make direct contact with the skin."	1.5	CO1
Q 10	What is the relatively static membrane potential of quiescent cells called? a. Half-cell potential b. Action potential c. Resting membrane potential d. Cell potential	1.5	CO1
Q 11	Before placing the electrodes, the skin should be _____ a. wet b. dry c. hairy d. oily	1.5	CO1
Q 12	Silver -Silver Chloride electrodes are prepared by the process of a. centrifugation b. etching c. manually d. electrolysis	1.5	CO1
Q 13	Normal average heart rate is _____	1.5	CO1
Q 14	List three processes that occur in kidneys during urine formation.	1.5	CO1
Q 15	Which of these is important for carbon dioxide electrode a. H_2SO_4 b. $NaHCO_3$ c. NaCl d. H_2^+	1.5	CO2
Q 16	When an abdominal ultrasound is done, why is it advised to have a full bladder? a. To have a good acoustic window b. To increase the water content c. To lower the impedance d. To allow for better propagation of waves	1.5	CO2
Q 17	What is the sound motion curves called? a. Frequency b. Cycle c. Overtone d. Waveform	1.5	CO2
Q 18	Name one parameter is measured in the blood test.	1.5	CO2
Q 19	Write the full form of GFR.	1.5	CO2

Q 20	List any one quantitative measurement of human body physiology.	1.5	CO2
	Section B **(4Qx5M=20 Marks)**		
Q 21	Identify two methods of creating electrode potential. **(2 marks)** List the three types of electrode-electrolyte biopotential electrodes used in biomedical devices. **(3 marks)**	5	CO1
Q 22	a. Define transducer. **(1 mark)** b. Draw the basic circuit of a transducer. **(2 marks)** c. Explain the two primary components of a transducer **(2 marks)**	5	CO2
Q 23	Summarize the methodology and findings of the experiment conducted by scientists to find the direction of movement of the electric current in the heart.	5	CO2
Q 24	a. Explain how an electromyogram (EMG) is measured and its use. **(2.5 marks)** b. Explain the concept of motor unit action potential associated with EMG with the help of a diagram. **(2.5 marks)**	5	CO2
	Section C **(2Qx15M=30 Marks)**		
Q 25	a. List which parameter is measured using ECG. **(1 marks)** b. Draw and label various parts of an ECG wave. **(2 marks)** b. Use your understanding of changes in ECG wave patterns associated with pathological conditions to briefly describe each of the following conditions and draw their corresponding ECG waves **(2*6 = 12 marks)** i. Normal rhythm ii. Bradycardia iii. Tachycardia iv. Arrhythmia v. Atrial Fibrillation vi. Ventricular Fibrillation	15	CO3
Q 26	a. Identify different stages of sleep and illustrate their corresponding patterns of EEG waves. **(1*3 = 3 marks)** b. Distinguish between the following EEG types based on the protocol and what can be inferred about the human body using each type**. (2*6 = 12 marks)** i. Routine EEG ii. Prolonged EEG iii. Ambultory EEG iv. Video EEG v. Sleep EEG vi. Sleep deprived EEG	15	CO4

Section D (2Qx10M=20 Marks)			
Q 27	A blood gas analyzer requires blood and measures blood pH, oxygen, and carbon dioxide concentration. Demonstrate the working mechanism of the pH electrodes in the blood gas analyzer with a corresponding diagram and equations occurring at the anode and cathode for high and low pH outside the electrode.	10	CO3
Q28	a. Compare the function of the kidneys and the hemodialyzer. **(2 marks)** b. Identify and explain the two processes that occur during hemodialysis **(2*2 = 4 marks)** c. Outline and explain the three methods of placing vascular access in hemodialysis. **(1.5*3 = 4.5 marks)**	10	CO4