Total number of printed pages: **Programme(UG)/ 7th Semester/UIE712**

2022

BIOMEDICAL INSTRUMENTATION

Full Marks : 100

Time : Three hours

The figures in the margin indicate full marks for the questions.

*Answer **any five** questions.*

1.	a)	How do human cells behave under natural state and under the application of stimulus? What are the challenges in the measurement of bioelectric signals? Briefly explain how biopotential generated by an organ can be measured using bioelectrodes.	2+2+3=7
	b)	Describe about metal microelectrode and micropipette type microelectrode with necessary diagrams.	3+3 = 6
	c)	What is the function of preamplifier in biomedical instruments? How differential amplifier nullifies the common mode noise? With the help of circuit diagram explain the working of differential amplifier.	1+2+4=7
2.	a)	Explain the cardiovascular circulation in the body with neat diagram.	6
	b)	What are the different types of leads in ECG? What is the significance of Einthoven triangle in electrocardiography? Draw the circuit configurations of lead II, aVR and C_1.	2+2+3 = 7
	c)	What is phonocardiography? What happens to the phonocardiogram if there is atrial murmurs? With the help of neat diagram explain how the pulse rate can be measured by photoplethysmography?	2+1+4=7
3	a)	What is stroke volume? How cardiac output can be measured by thermal dilution method?	1+4=5
	b)	Briefly describe the mechanism of respiration in the human body with the help of diagram.	5
	c)	Define the following terminologies- tidal volume, total lung capacity and inspiratory reserve volume. Write the working principle of basic water sealed spirometer. How ultrasonic spirometer gives the measurement of velocity of inhaled air?	3+3+4=10

4.	a)	Under what heart conditions artificial pacemaker is needed? What do you mean by R wave-triggered and R wave-inhibited pacemaking?	1+4 =5
	b)	What are the common voltage and current specifications of the pacemaker pulse to be directly applied on heart?	2
	c)	What do you mean by fibrillation? What is monophasic and biphasic defibrillation? Briefly explain the circuit for generating defibrillation shock.	1+2+3=6
	d)	With the help of block diagram explain the functions of the building blocks of CT scan machine.	7
5	a)	What is positive pressure ventilation- briefly explain with diagram? What is the difference between controller and assistor type ventilator?	4+2=6
	b)	What are the principles of electro-surgical cutting and coagulation?	2+2=4
	c)	What are the advantages of ultrasound in imaging-based diagnosis as compared to the X-rays? Explain about ultrasound A and M scans?	2+4=6
	d)	Briefly discuss the operation of a thermograph.	4
6	a)	Explain the working principle of nuclear magnetic resonance imaging system.	10
	b)	Under normal condition, is the human blood alkaline or acidic? What is the function of buffer solution in pH measurements? Explain a method for measurement of partial pressure of O_2.	1+1+5 =7
	c)	Briefly explain the optical method of counting blood cells.	3
7	a)	What do you mean by gross shock and micro current shock? What are the different types of leakage currents that are relevant in biomedical measurement systems -briefly explain each of them?	2+5=7
	b)	How the chassis leakage current of a biomedical instrument is measured?	5
	c)	Write short notes on any two of the following i) Non invasive method of blood pressure measurement ii) Instrumentation amplifier iii) X-ray machine	2 x 4=8