Total No. of printed pages = 4

19/6th Sem/DIE 602

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) What is the function of signal conditioning element ? What are the problems encountered in measuring physiological parameters from living system ? – Explain. 1+6=7

   (b) Briefly describe about respiratory system of human being. 5

   (c) Define absolute and relative refractory period. How action potential is generated in the cell ? Explain the phenomena of repolarization of cell. 2+2+4=8

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2. (a) How action potential propagates from cell to cell ? Which type of cells has the highest speed of propagation ? 3+1=4

(b) Describe how excitation pulse generated by sinoatrial node in heart reaches the ventricles for pumping the blood to the whole body. 6

(c) Discuss about EOG and EMG signals and their measurements, along with their graphical representations. 5+5=10

3. (a) Define the electrode theory and write the Nernst equation of potential across membrane. 1+2=3

(b) What are the three main classes of electrodes used for measurement of potential from different parts of the body ? Describe the different types of surface electrodes with their sketches. 2+6=8

(c) What are the main drawbacks of differential amplifier ? How a subject is isolated from the electrical equipments in body parameter measurements. Draw the circuit diagram of instrumentation amplifier and provide its expression of voltage gain. 2+3+4=9

4. (a) With the help of examples define active, passive and inductive transducers. What are the criteria for choosing a suitable transducer for measuring physiological parameters ? 3+6=9

(b) Explain the working of a resistive and an inductive type displacement transducers with the help of necessary diagrams. 4+4=8

(c) Briefly describe an application of photoelectric transducer. 3

5. (a) Write about a method for blood pressure measurement. 4

(b) What is meant by cardiac output ? Briefly explain Fick's method of measuring cardiac output. 1+4=5

(c) Explain the working of ultrasonic blood flow meter with necessary diagram. 6

(d) What is Eithoven triangle ? Which of the bipolar leads gives the highest amplitude of R wave ? Draw the lead configuration of augmented vector leads of ECG. 1+1+3=5

6. (a) What do you mean by smart sensors ? Briefly describe with examples. 4

(b) Name the different types of ECG recorders. Whether an ECG recording can provide the details about cardiac murmurs ? Which type of transducer is suitable for heart sound measurement ? 2+1+1=4

(c) Draw the block diagram of an ECG machine and briefly describe the functions of each block. 6

(d) What is the frequency range of medical ultrasonic wave ? Write a brief note on medical ultrasound. 1+5=6

7. (a) Describe how X-rays are generated ? What are the visualization methods of X-rays ? 6+2=8

(b) What is the working principle of X-ray computed tomography ? 4

(c) In case of cardiac arrest of a patient which device is required ? What is the difference between a fixed pacemaker and demand pacemaker ? Briefly describe about positive pressure ventilator. 1+2+5=8