Reg. No.

B.E./B.Tech. DEGREE EXAMINATIONS APRIL / MAY 2021

Eighth Semester

Electrical and Electronics Engineering

EI8073 Biomedical Instrumentation

Common to Electronics and Instrumentation/Instrumentation and Control Engineering

(Regulations 2017)

Time : 3 Hours   Answer ALL Questions   Max. Marks: 100

PART-A (10 x 2 = 20 Marks)

1.   List the components of a biomedical system.

2.   Compare active and passive transducers.

3.   Define systole and diastole.

4.   Identify the reason for the decrease in cardiac output.

5.   Draw Einthoven triangle and how it is used in ECG measurement?

6.   Classify the four types of surface electrode.

7.   Recall the principle behind the MRI.

8.   Draw the block diagram of a bio-telemetry system and list its component.

9.   State ventricular fibrillation.

10. Point out the variables to be monitored by a patient monitoring system.

PART -B (5 x 13 = 65 Marks)

11. a) Explain the mechanism of generation of action potential and write the necessary equations and mention different stages of action potential.   (13)

OR

b) (i)   Illustrate the working of ultrasonic transducers and discuss its application.   (6)

(ii) Describe in detail how pulsatile blood volume changes can be measured using photoelectric type resistive transducer.   (7)

1

12. a) (i) Explain the measurement methods of Galvanic skin response (GSR) and Basal Skin Resistance (BSR). (7)

   (ii) Explain the measurement of heart sound with suitable diagram. (6)

OR

   b) (i) Explain the measurement of blood pO2 and pCO2. (7)

   (ii) Explain how whole body plethysmography is used to measure total lung capacity. (6)

13. a) Draw and explain the block diagram of single ended chopper-stabilized operational amplifier. (13)

OR

   b) Summarize the instruments used to check the safety parameters of biomedical equipment. (13)

14. a) (i) Write the construction and working principle of computer tomography. (7)

   (ii) Explain the working of multichannel biotelemetry system. (6)

OR

   b) (i) Write the properties of ultrasound and explain how ultrasound can be used for diagnosis. (7)

   (ii) Explain the concept of imaging application of Biometric system. (6)

15. a) Draw and explain the simplified circuit diagram of a microwave diathermy machine and its uses. (13)

OR

   b) Describe the application of Advanced 3D surgical techniques used in biomedical field in the world. (13)

PART C (1 x 15 = 15 Marks)

16. a) Muscle thickness = 1.5 cm. Bone thickness = 1.5 cm. Incident X-ray intensity = 15 kW/m^2. When the incident X-ray photon energy is equal to 80 keV, the mass attenuation constant for bone and muscle are 0.0052 m^2/kg and 0.0025 m^2/kg respectively. The bone and muscle have the density equal to 1850 kg/m^3 and 1060 kg/m^3 respectively. Determine the ratio between the emergent X-ray intensity from bone and muscle. Also calculate the contrast in the image on film made by the emergent X-rays from bone and muscle. (15)

OR

   b) A defibrillator delivers a square pulse of 4000 V with a duration of 4 milliseconds. The internal resistance of the defibrillator is about 15 ohms. The skin-electrode resistance is 50 ohms and the thorax resistance is 30 ohms. Compute the energy delivered to the patient's thorax and the total energy available from the defibrillator. Also calculate the percentage of loss of energy. (15)