B. Tech.
(SEM. VIII) EXAMINATION, 2006-07
BIO-INSTRUMENTATION

Time : 3 Hours] [Total Marks : 100

1. Attempt any four parts of the following : 5x4=20

(a) Give a block diagram representation for a bio-instrumentation system and explain its various system components.

(b) Discuss the basic objectives of a general instrumentation system. Also briefly explain the difference between clinical instrumentation and research instrumentation systems.

(c) Write in brief about the problems encountered in the measurement of biological signals.

(d) Give the working principle of a strain gauge transducer. What are its merits and sources and errors. Write any two applications of it in the area of bio-medical engineering.
(e) What is a piezoelectric transducer? What are its limitations? Give its dynamic model and also its output equation (response) under steady state condition.

(f) Explain the difference between isometric and isotonic transducers. Give examples of each.

2 Attempt any four parts of the following: \[5 \times 4 = 20\]

(a) What is a biopotential? Name six types of biopotential sources. Also explain polarization, depolarization, and repolarization.

(b) Explain the electrical action of the sinoatrial node.

(c) Name the three basic types of electrodes for measurement of bioelectric potentials. Why are microelectrodes sometimes needed?

(d) How are the potentials in muscle fibers measured and what is the record called that is obtained therefrom? Also draw the nature of the potentials recorded.

(e) Describe in brief the working principle of a blood pH meter. Also mention the features of its commonly used electrodes.

(f) Explain the construction and working of pCO₂ electrode.

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3 Attempt any two parts of the following: 10×2=20

(a) Explain the operation of the heart and the cardiovascular system briefly. Draw an analogous electric circuit and how the fundamental laws of electrical engineering could apply in the analogy.

(b) Draw the waveshape of blood pressure on a time-base and explain it. What is the dicrotic notch? Also define systole and diastole.

(c) Describe in brief the ECG recording principle. Explain the requirements of the ampler and electrode/leads in the recording system.

4 Attempt any two parts of the following: 10×2=20

(a) Discuss possible causes of a patient - monitoring system falsely indicating an excessive high heart rate. What is a ‘demand’ pacemaker and when it is used?

(b) What do you understand by fibrillation? How do you correct for it? Draw a circuit of a direct - current defibrillator and explain its working.

(c) What do you understand by the term ‘noninvasive methods’? Explain the working principle and also give a comparison between a thermistor and a thermocouple in temperature measurement.
5 Attempt any two parts of the following: \[10 \times 2 = 20\]

(a) Discuss telemetry as an emergency care tool. Explain how four physiological parameters can be monitored and telemetered simultaneously.

(b) Explain the principle of computerized axial tomography and compare its method of visualization with conventional X-ray methods.

(c) Write short notes on the following:
   (i) Magnetic resonance imaging systems.
   (ii) Laser applications in bio-medical field.