Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.Tech(BME)/SEM-5/BME-502/2009-10

2009

BIOMEDICAL INSTRUMENTATION

Time Allotted : 3 Hours | Full Marks : 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives of the following : $10 \times 1 = 10$

   i) The Galvanic Skin Response (GSR) measurement is used to know the

      a) cardiac activity of heart

      b) functional activity of heart

      c) dermal activity of sweat gland

      d) none of these.

   ii) How many numbers of current injecting electrodes are used in tetrapolar impedance measurement technique ?

      a) 1 b) 3

      c) 4 d) 2.

   iii) Which of the following should be as high as possible for a measuring instrument ?

      a) Signal to noise ratio b) Hysteresis

      c) Range d) Frequency response.

iv) Central patient monitoring stations usually monitor upto ..... patient(s).

a) one b) four

c) eight d) thirty.

v) The upper limit of blood pressure is known as

a) systolic pressure

b) diastolic pressure.

vi) The degree to which variations in the output of an instrument follow input variations is referred to as

a) sensitivity b) linearity

c) hysteresis d) accuracy.

vii) The frequency range of ECG wave is

a) 0·05 — 100 Hz b) 0·5 — 160 Hz

c) 0·05 — 160 Hz d) 10 — 100 Hz.

viii) A pressure measurement instrument is calibrate between 10 bar and 250 bar. The scale span of the instrument is

a) 10 bar b) 250 bar

c) 240 bar d) 260 bar.

ix) The ratio between output voltage signal and input voltage signal in an instrument is defined as

a) precision b) resolution

c) gain d) CMRR.

x) Apnoea is

a) absence of breathing b) absence of heartbeat

c) kidney failure d) none of these.

GROUP – B
(Short Answer Type Questions)

Answer any *three* of the following. 3 × 5 = 15

2. Briefly discuss a procedure of the measurement of cardiac output. 5

3. What is the medical significance of impedance pneumography ? Discuss a procedure of the measurement of impedance pneumography. 1 + 4

4. What is biopotential amplifier ? Discuss in brief, the characteristics of a biopotential amplifier. 1 + 4

5. Explain Korotkoff method of indirect blood pressure measurement. 5

6. What are the physiological effects of electric current on human body ? What are microshock and macroshock ? 5

7. How electrostatic and electromagnetic signals become a source of noise to biosignals ? Briefly explain how it can be eliminated. 5

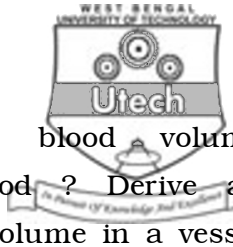
GROUP – C
(Long Answer Type Questions)

Answer any *three* of the following. 3 × 15 = 45

8. a) Describe the 12-lead ECG system with reference to the Einthoven triangle.

   b) Draw the block diagram of the ECG machine, explaining the function of each block. 8 + 7

9. a) Explain the impedance-frequency characteristics of living tissue with a neat diagram. How does the endocrine activity modify the body impedance characteristics ?



b) What is the principle behind blood volume measurement by impedance method ? Derive an equation for the variation of blood volume in a vessel with the change in its basal resistance.

c) Describe the method of Thoracic Impedance Cardiography. 5 + 6 + 4

10. a) What special features of bioelectric amplifiers make them suitable for Biomedical applications ?

b) With a suitable circuit diagram, explain the operation of an instrumentation amplifier and derive for the overall gain of the amplifier.

c) With a suitable circuit, prove that isolation amplifier is a good noise eliminator as well as suited for biomedical application. 3 + 5 + 7

11. a) With suitable diagram, explain the recording instrumentation of an ECG.

b) Explain the procedure following for undergoing cardiac stress test.

c) How application of microprocessor and flash memory chips aided the recording process of bioelectric events ? 6 + 5 + 4

12. What are the different components of a patient monitoring system ? Explain with neat block diagram. What parameters does it measure ? 5 + 5 + 5

13. a) Write a short notes on Holter Monitor. $7\frac{1}{2}$

b) Write a note on apnea detectors. $7\frac{1}{2}$