



Name :

Roll No. :

Invigilator's Signature :

CS/B.Tech/BME(O)/SEM-5/BME-502/2012-13

2012

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 for any *ten* of the following :

10 × 1 = 10

i) 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.

ii) Which of the following should be as high as possible ?

- a) Signal to Noise ratio
- b) Hysteresis
- c) Range
- d) Frequency response.



iii) Which among the following is the best measure to reduce power supply to instruments ?

- a) Protection by low voltage
 - b) Double Insulation
 - c) Grounding
 - d) Isolation.
- iv) Central patient monitoring stations usually monitor up to patients.
- a) one
 - b) four
 - c) eight
 - d) thirty.
- v) The upper limit of blood pressure is known as
- a) systolic pressure
 - b) diastolic pressure
 - c) cerebrospinal fluid pressure
 - d) venous pressure.
- vi) The frequency range of ECG wave is
- a) 0.05 Hz – 100 Hz
 - b) 0.5 Hz – 160 Hz
 - c) 0.05 Hz – 160 Hz
 - d) 10 Hz – 100 Hz.



vii) The value of let-go current in males is

- a) 5 mA
- b) 9 mA
- c) 16 mA
- d) 21 mA.

viii) The frequency range of α -wave is

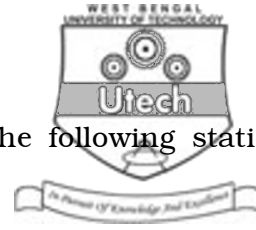
- a) 8 Hz – 13 Hz
- b) 18 Hz – 23 Hz
- c) 45 Hz – 76 Hz
- d) 2 Hz – 5 Hz.

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 heart beat
- c) Kidney failure
- d) None of these.



xi) In measurement system, which of the following static characteristic(s) is / are desirable ?

- a) Accuracy
- b) Sensitivity
- c) Reproducibility
- d) All of these.

xii) A pressure measurement instrument is calibrated 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.

xiii) A set of reading has wide range and therefore it has

- a) low precision
- b) high precision
- c) low accuracy
- d) high accuracy.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. $3 \times 5 = 15$

2. What is biopotential amplifier ? Discuss in brief the characteristics of a biopotential amplifier. 1 + 4
3. Differentiate between the accuracy and precision with examples. 5



4. Explain Korotkoff method of indirect blood pressure measurement. 5
5. Draw the schematic diagram of Man-Instrument system and describe its various components. 5
6. What are physiological effects of electric current ? 5
7. What are the physiological effects of electric current on human body ? What are micro-shock and macro-shock ? 5
8. 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

9. 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



10. 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
11. What are the different preventive measures to reduce electrical shock hazards ? 15
12. What is a patient monitoring system ? Explain with neat block diagram. What parameters does it measure ? 3 + 12
13. What is ultrasound ? How is it used for measuring blood pressure ? 3 + 12
14. 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
15. a) With suitable diagram, explain the recording instrumentation of an ECG.
- b) Explain the procedure followed for undergoing cardiac stress test.
- c) How application of microprocessor and flash memory chips aided the recording process of Bioelectric events ? 6 + 5 + 4

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