Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.TECH(BME)/SEM-5/BME-502/2010-11

2010-11

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 the following : $10 \times 1 = 10$

i) An Isolation amplifier acts as

a) Bio-weapon b) Energy destroyer

c) Energy converter d) All of these.

ii) An instrumentation amplifier is basically a kind of

a) Isolation amplifier b) Chopper amplifier

c) Differential amplifier d) Carrier amplifier.

iii) The skin layer that provides a natural protection against electrical danger is

a) Endothelium b) Muscles

c) Epithelium d) None of these.

iv) Which of the following is/are desirable static characteristic (s) ?

a) Reproducibility b) Accuracy

c) Sensitivity d) All of these.

v) GSR measurement is based on the activity of the

a) Neurons b) Epidermal cell

c) Sweat gland d) Myocardial cell.

vi) The basic role of an electrode is to convert

a) Light signal to ionic signal

b) Ionic signal to electrical signal

c) Electrical signal to light signal

d) Light signal to electrical signal.

vii) The best measure to reduce power supply to instruments is

a) Isolation

b) Grounding

c) Low voltage protection

d) Double isolation.

viii) In gross shock, the current flows through

a) the intestine b) the lungs

c) the heart d) limb to limb.

ix) Action potential is approximately equal to

a) + 70 mV b) + 20 mV

c) – 20 mV d) – 70 mV.

x) An ICU/CCU does not use

a) Anesthesia machine b) Bedside monitor

c) Syringe pump d) Defibrillator.

GROUP – B

(Short Answer Type Questions)

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

2. a) How do static characteristics of an instrument differ from its dynamic characteristics ?

   b) Differentiate between "Reproducibility" and "Repeatability" ? 3 + 2

3. With a neat block diagram, focus on the significance of Biofeedback instrumentation.

4. a) Draw the equivalent circuit of a biopotential electrode.

   b) Justify the use of electrode paste in biopotential measurements. 2 + 3

5. What are the factors to be considered during biomedical measurements ? Draw an electrical equivalent circuit of skin impedance. 3 + 2

6. How do microprocessors find its applications in contemporary medical instruments ?

7. a) What does "let go current level" stand for ? What is the average value of "let to current" ?

   b) What is the value of perception threshold of the skin for light finger ?

   c) What does ICU/CCU stand for ? (2 + 1) + 1 + 1

GROUP – C

(Long Answer Type Questions)

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

8. a) With a neat diagram briefly discuss the different components of an Isolation amplifier. Represent an Isolation amplifier symbolically.

   b) Design an Instrumentation amplifier with 3 op-amps. Hence find its gain. (6 + 2) + 7

9. a) What is the key difference between GSR and BSR ? What is the medical significance of GSR measurement ? Describe the procedure of GSR measurement.

   b) Is there any difference between skin impedance and skin-contact impedance ? Justify your answer. What is the range of normal skin impedance ?

   (1 + 2 + 7) + (4 + 1)

10. a) Define the following terms :

    i) Cardiac output

    ii) Stroke volume.

b) What is Plethysmography ? With a proper diagram discuss the operating principle of a 'true' plethysmograph. (2 + 2) + (2 + 9)

11. a) Differentiate between macro-shock and micro-shock. Draw a generalized model of an electrical accident.

b) Discuss the physiological effects of electrical current in human body. (3 + 3) + 9

12. a) Discuss the significance of the 'Einthoven Triangle' in ECG measurement.

b) Name the different leads used in ECG measurements.

c) Explain the method of blood pressure measurement by using Korotkoff's method.

d) Explain the differences between neutral and ground.

5 + 2 + 5 + 3

13. Write short notes on any *three* of the following : 3 × 5

a) Man-Instrument system

b) Biofeedback instrumentation

c) Chopper amplifier

d) Phase sensitive detector (PSD)

e) Shock hazards from electrical equipment

f) Classification of errors in measurement

g) Data acquisition system.