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# RM-7787

## B. E. - IV (IC) (Sem. VIII) Examination

**May / June – 2010**

## Biomedical Instrumentation

*(Elective-I)*

Time : **3** Hours] [Total Marks : **100**

**Instructions :**

(1)

નીચે દર્શાવેલ ☛ નિશાનીવાળી વિગતો ઉત્તરવહી પર અવશ્ય લખવી.
**Fillup strictly the details of ☛ signs on your answer book.**

Name of the Examination :

☛ **B. E. - 4 (IC) (Sem. 8)**

Name of the Subject :

☛ **Biomedical Instrumentation (Elective-1)**

☛ Subject Code No. : **7 7 8 7** ☛ Section No. (1, 2,.....) : **1&2**

Seat No. :

Student's Signature

(2) Answers to each section must be written in separate answer books.
(3) Figures to the right indicate maximum marks.
(4) Draw neat figure wherever required.

### SECTION - I

**1** Answer the short questions : (one mark for each) **10**

(i) Name four valves in the heart.
(ii) State Ohm's law for blood flow.
(iii) The _____ is the heart's pacemaker.
(iv) The delay line in the heart's electro-conduction system is called the _____.
(v) Action potentials have amplitude of about _____ mV.
(vi) The heart muscle is called _____.
(vii) Blood velocity in capillaries is (faster) / (slower) than its velocity in the aorta.
(Select one from underlined)
(viii) Draw a structure of single neuron.
(ix) The five principal structures of the heart's electroconduction system are _____, _____, _____, _____ and _____.
(x) A pressure of about _____ mmHg is required to open the aortic valve.

2 (a) For frog skeletal muscle, typical values for the intracellular and extracellular concentrations of the major ion species (in millimoles per litre) are as follows : **5**

| Species | Intracellular | Extracellular |
|---|---|---|
| $Na^+$ | 20 | 170 |
| $K^+$ | 150 | 10 |
| $Cl^-$ | 6 | 140 |

Assume room temperature 30°C and typical values of permeability coefficient for skeletal muscle $P_{na} = 1.8 \times 10^{-8} cm/s$, $P_k = 1.8 \times 10^{-6} cm/s$ and $P_{Cl} = 4.00 \times 10^{-6} cm/s$. Calculate the equilibrium resting potential for this membrane, using Goldman equation.

(b) Brief about following terms in context of action potential : **7**
(i) Stimulus,
(ii) Polarization
(iii) Depolarization
(iv) Hyperpolarization
(v) All or None action
(vi) Absolute refractory period
(vii) Relative refractory period.

(c) Discuss medical measurement constraints in detail. **6**

(d) What is "motion artifact" ? Justify : A motion artifact - a serious cause of interference in the measurement of biopotential. **6**

3 (a) Explain working of Silver/silver chloride electrode. State it's fabrication process. Also discuss it's advantages and limitations. **6**

(b) Discuss various layer of skin. Discuss equivalent circuit for electrode-skin interface in detail. **8**

(c) What is Reflex arc ? **2**

**OR**

3 (a) What are the sources of electric-field interference ? Explain with derivation, the importance of CMRR. **8**

(b) Discuss the considerations for electrode for stimulation of tissues. **6**

(c) For what electrodes are tested against the defibrillation effect. **2**

## SECTION - II

| | | | |
|---|---|---|---|
| **4** | Answer the short questions : | | |
| | (i) | What is Microshock ? | **2** |
| | (ii) | The fourth heart sound is correlated to _____. | **1** |
| | (iii) | Explain let-go current and list out different parameters on which the let go current depends. | **2** |
| | (iv) | Draw connection diagram augmented lead - aVR. | **2** |
| | (v) | Draw vector diagram which shows standard and augmented lead-vector directions in the frontal plane. | **2** |
| | (vi) | The peak amplitude on the ECG waveform is approximately _____ mV. | **1** |
| | (vii) | The respiratory system counteracts sudden changes in blood _____. | **1** |
| | (viii) | An ECG monitor usually has a frequency response of 0.05 to about _____ Hz. | **1** |
| **5** | (a) | Explain Right-leg driven circuit in detail. | **7** |
| | (b) | What are the basic requirements of biopotential amplifier. | **7** |
| | (c) | Explain the block diagram of basic pulse-echo apparatus. | **6** |
| **6** | (a) | List and describe the major parameters of respiration. | **6** |
| | (b) | Explain helium-dilution estimate of lung volume. | **7** |
| | (c) | Explain spirogram. | **5** |
| | | **OR** | |
| **6** | (a) | Describe the indicator dilution method that uses continues infusion method to estimate the flow of blood. | **8** |
| | (b) | Name the six physiological effects of electricity and describe any one. | **6** |
| | (c) | Explain body plethysmography. | **4** |