Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.TECH(BME-OLD)/SEM-4/BME-403/2012

2012
BIOPHYSICS

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) Which of the following is not a radio isotope ?

   a) ^{14}C b) ^{32}P

   c) ^{131}I d) ^{14}N.

   ii) In ECG vector cardiography, the first vector represents

   a) atrial depolarization

   b) spike potential

   c) ventricular depolarization

   d) none of these.

iii) Normal resting potential of the nerve cell is

a) + 30 mV inside with respect to the outside

b) + 15 mV outside with respect to the inside

c) – 90 mV inside with respect to the outside

d) – 70 mV outside with respect to the inside.

iv) Conduction pathway for electric signal in heart is

a) SA note → AV node → Purkinje fibres

b) SA node → Bundle of His → AV node → Purkinje fibres

c) SA node → AV node → Bundle of His → Purkinje fibres

d) AV node →Bundle of His → Purkinje fibres.

v) Ballistocardiography is

a) measurement of velocity of ballistic missiles

b) measurement of ball striking capability of a striker

c) measurement of movement of the body due to movement of the blood

d) measurement of forces exerted on the body due to the movement of the blood.

vi) The proportion of light transmitted (I/I_0) is called the

a) transmittance b) absorbance

c) optical density d) none of these.

vii) Magnetic field effects on human body due to the

a) presence of H^+ inside the body

b) presence of water inside the body

c) presence of Na^+ inside the body

d) presence of oxygen inside the body.

viii) Arrhythmia is

a) abnormal heart sound

b) abnormal heart rate

c) abnormal heart frequency

d) abnormal heart beating.

ix) Alpha block occurs

a) in EOG b) in EEG

c) in ECG d) in EMG.

x) The application of an electric shock (defibrillation) to resynchronize the heart is sometimes called

a) cardioversion b) dc defibrillation

c) counter shock d) none of these.

GROUP – B

(Short Answer Type Questions)

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

2. With suitable diagram, explain the voltage clamp technique for measurement of EMF of living cell.

3. What is microwave ? What is the microwave frequency band range ? For what purpose is it commonly used on patients in a hospital ? 1 + 2 + 2

4. What are the main electrolytes present in biological fluid ? Briefly explain a procedure for the determination of conduction of biological fluid. 1 + 4

5. Briefly discuss the bipolar limb-lead system for ECG measurement. What are the parameters used for the diagnosis of ECG signal ? 3 + 2

6. State the laws of photochemistry. What is fluorescence ? Give an example of a fluorescent material. 3 + 1 + 1

7. With the empirical relation, state the law of radioactive decay. What is half-life period ? 3 + 2

GROUP – C

(Long Answer Type Questions)

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

8. a) Define fibrillation. How does a defibrillator perform to overcome the irregular rhythm of heart. 2 + 7

   b) How is the term 'vulnerable period' related with fibrillation ? What is ballistocardiography ? 3 + 3

9. What do you mean by macroshock and microshock in the physiological measurement ? What is "Let go current" ? Briefly discuss the magnetic properties of biological substances. Give brief outlines of merits and demerits of magnetic field and radio waves in the biological system.

4 + 1 + 4 + 6

10. What is the electrical activity of human brain ? Briefly discuss about the recording electrodes of EEG signals. Do you think that the electroencephalogram is subject to frequency discrimination ? Explain. What is electroretinography ? 2 + 6 + 4 + 3

11. With empirical relation and diagram, explain Beer-Lambert law. Relate absorbance with light intensity. Describe Arrhenius equation and use the same to calculate the activation energy (E_a) for a reaction from the following data :

Temperature (*K*)	**Rate constant (M/s) × 10^{-6}**
573	2·91
673	838
773	76500

3 + 2 + 3 + 7

12. a) Explain the method of pair production during interaction of X-ray and γ-ray with matter.

b) Briefly explain about biological transducer.

c) A block of tissue consists of 2 cm fat, 3 cm muscle (across fibre) and 4 cm liver. Calculate the total energy loss in dB when 1 MHz ultrasound passes through that block. [at 1 MHz $\alpha_{fat} = 0 \cdot 6$ dB/cm, α_{muscle} (across fibre) = 3·3 dB /cm, $\alpha_{liver} = 0 \cdot 9$ dB/cm]

5 + 4 + 6

13. What do you understand by vector cardiography ? With the help of vector cardiography, explain the flow of electrical impulse in the heart. What are the different types of electrocardiographic leads ? With the help of a suitable diagram, explain the position of the leads. 3 + 5 + 3 + 4