Marks Scored:

KATHMANDU UNIVERSITY
End Semester Examination
May/June, 2022

Level : B.E.
Year : III
Course : ETEG 321
Semester : II
Exam Roll No. :
Time: 30 mins.
F. M. : 10
Registration No.:
Date :

SECTION "A"
[20 Q. × 0.5 = 10 marks]

Encircle the most appropriate option.

1. The positive potential of the cell membrane during excitation is
   a. Action potential
   b. Drift potential
   c. Diffusion potential
   d. Passive potential

2. A _____ needle electrode contains both active and reference electrodes within the same structure.
   a. Earth ring
   b. Hypodermic
   c. Paddle
   d. Concentric core

3. The velocity range of Purkinje fibre is
   a. 50-60 m/s
   b. 2-4 m/s
   c. 10-20 m/s
   d. 0.5-0.6 m/s

4. What is the cause for smeared trace of ECG machine?
   a. Incorrectly loaded paper
   b. Incorrect pressure on the paper
   c. Incorrect placement of lead selector
   d. Incorrect placement of pen tip

5. Regarding the following two statements, which option best represents all or nothing law?
   S1: Action potential is always the same for any given cell
   S2: Intensity of stimulus is assumed to be greater than threshold of stimulus
   a. S1 true, S2 false
   b. S1 and S2 true
   c. S1 and S2 false
   d. S1 false, S2 true

6. Which of the following is an essential part of biomedical instrumentation system?
   a. Amplifier
   b. Transmitter
   c. Modulator
   d. Multiplexer

7. Which of the following imaging technology uses a radioactive isotope?
   a. X-Ray Imaging
   b. Ultrasound
   c. Nuclear medicine imaging
   d. None

8. The primary x-ray beam penetration (percent) through a patient can be increased by increasing the
   a. kVp.
   b. mAs.
   c. Filtration.
   d. Beam area.

9. Which of the following represents the correct sequence based on fastest to slowest penetration of ultrasound?
   a. Lung, fat, soft tissue, liver, blood, muscle, tendons, bone
   b. Bone, tendons, muscles, blood, liver, fat, soft tissue, lung
   c. Bone, tendons, muscles, blood, liver, soft tissue, fat, lung
   d. Bone, Muscles, tendons, blood, liver, soft tissue, fat, lung

10. What does precession means in imaging?
    a. The spinning of Hydrogen protons around their own axis
    b. Change in orientation of Hydrogen molecules when exposed to radio waves at the Larmour frequency
    c. The wobble of Hydrogen protons exposed to an external magnetic field
    d. Water molecules gain an extra molecule of Hydrogen when exposed to a magnetic field

11. Increasing the magnetic field in an MRI
    a. produces less susceptibility artifacts.
    b. reduces the risk of tissue heating.
    c. increases the signal to noise ratio.
    d. reduces the danger from metallic projectiles.

12. A defibrillator is used to
    a. increase the heart rate
    b. correct arrhythmias
    c. decrease heart rate
    d. increase blood pressure

13. Contact angle method determines
    a. hydrophobicity/hydrophilicity
    b. porosity
    c. Modulus of elasticity
    d. crystallinity

14. Which of the following implants are MR safe?
    a. Hip implants b. Ocular implants c. Heart valves d. None of the above

15. As an ultrasound pulse moves through tissue in a patient's body it will undergo a change in
    a. Intensity
    b. Amplitude (energy)
    c. Physical size.
    d. All of the above

16. What should be the frequency response of the amplifiers that are used for the amplification purpose of the input signal in medical devices?
    a. High frequency response
    b. Low frequency response
    c. Frequency response has no role to play in it
    d. Average frequency response

17. Which of the following wave is seen in an adult while they are in rest but awake?
    a. Alpha wave b. Beta wave c. Delta wave d. Theta wave

18. What is the maximum level of current that causes ventricular fibrillation?
    a. 50 mA b. 6 A c. 1 A d. 100 mA

19. The energy level of a dc defibrillator ranges from:
    a. 4 - 400 Joules b. 2-200 Joules c. 2-400 Joules d. 1-500 Joules

20. Which of the following are not surface properties?
    a. Roughness b. Wettability c. Porosity d. Crystallinity

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F.M. : 40

SECTION "B"
[4Q. × 10 = 40 marks]

Attempt *ANY FOUR* questions. Use diagrams to explain your answers wherever necessary. Assume missing data.

1. a. Define biometrics. What are the things that need to be considered while designing medical instruments? [1+2]

   b. Define the terms action potential and resting potential. How is action potential generated? Explain the phenomenon in detail with necessary diagrams and graphs. [1+1+5]

2. a. Why is silver – silver chloride electrode the preferred choice to measure bioelectric potentials? How is the electric charge distributed at the electrode-electrolyte interface? [1+1]

   b. What is Einthoven's triangle? How does it relate to ECG measurement? Draw and explain the schematic diagram of ECG measurement using bipolar limb leads. [2+2+4]

3. a. Define Larmour frequency and write the Larmour equation. Explain the process of image formation in MRI? [1+5]

   b. What are the system components of a CT-Scanner? How does the scanning procedure of a CT-Scan differ from X- Ray Imaging? [1+3]

4. a. What do you mean by defibrillation? Draw a schematic diagram of a dc defibrillator and briefly explain its working mechanism. [1+2+2]

   b. What are Leakage currents? How do you prevent the hazards of such currents in a medical equipment? Explain with necessary circuit diagrams. [1+4]

5. Write short notes on (*ANY FOUR)*: [4Q. × 2.5 = 10]
   a. Contact Angle Method
   b. Surface Electrodes
   c. Piezoelectric effect
   d. Radiation Safety
   e. Coils used in an MRI Scanner