KATHMANDU UNIVERSITY
End Semester Examination
June/July, 2023

07 JUL 2023

Level : B.E.
Year : III
Time : 2 hrs. 30 mins.

Course : ETEG 321
Semester : II
F. M. : 40

SECTION "B"
[4Q. × 10 = 40 marks]

Attempt *ANY FOUR* questions. Symbols have their usual meanings. Necessary assumptions are permissible.

1. a. Design a simple implantable device using the concept that you get from your course on Principle of biomedical engineering. Also, provide your concern on ISO standards. [4]

   b. Compare and contrast CT-Scan and MRI Scan based on its working principle. [3]

   c. Elaborate on basic modes of Ultrasonography. [3]

2. a. Relate Einthoven's triangle with the lead placement for ECG with necessary diagrams and elaborate it. [4]

   b. Elaborate on working principle of x-ray with labelled diagram. [3]

   c. What are the key elements of evoked potential estimation? With an example of the practical usage of it, design a simple system based on this concept. [3]

3. a. Elaborate on electrical activity of heart with necessary diagrams. [3]

   b. Write short note on chemiluminescence - based biosensors and ampero-metric transducer. Elaborate on the application of transducers in the field of biomedical engineering. [4]

   c. If you are about to start a career as biomedical service engineer, what electrical safety procedures are you going to follow? Also, put your concern relating safety standard codes with some examples. [3]

4. a. With elaboration on terms, MUPs, NCV, neuropathy and myopathy, explain how EMG can be related with all these. [3]

   b. How is the principle of telemetry implied in telemedicine? Give appropriate practical examples. [3]

   c. What are the electrical hazards concerning human? [2]

   d. Explain photocoagulation. [2]

5. a. Elaborate on working principle of laser technology along with the practical examples of its usage in biomedical sector. [3]

b. What is 10-20 electrode system? How do you think EEG can be used for sleep analysis? [3]

c. With necessary diagrams, explain action and resting potential. [4]

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Registration No.:

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SECTION "A"
[20 Q. × 0.5 = 10 marks]

Encircle the most appropriate option.

1. Which organization is responsible for the development and publication of electrical safety standard codes in the biomedical field?
   a. ISO b. FDA c. OSHA d. IEC

2. What is the typical value of the resting potential of a cell?
   a. +70mV b. -70mV c. 0mV d. +30mV

3. Which of the following statements best describes wearable devices?
   a. Devices that can be worn as fashionable accessories, but have no practical functionality.
   b. Devices designed to be worn on the body that provide functionality and collect data.
   c. Devices used exclusively for tracking physical activity and fitness levels.
   d. Devices that are worn to enhance communication and social interactions.

4. Which of the following statements about implantable devices is **TRUE**?
   a. Implantable devices are used exclusively in the field of orthopedics.
   b. Implantable devices are only used for cosmetic purposes.
   c. Implantable devices are medical devices designed to be placed inside the body.
   d. Implantable devices are used primarily in veterinary medicine.

5. Which structure is primarily responsible for initiating and coordinating the electrical conduction of the heart?
   a. Atrioventricular (AV) Node b. Bundle of His (AV Bundle)
   c. Sinoatrial (SA) Node d. Purkinje Fibers

6. In electrocardiography (ECG), which lead configuration is commonly used to obtain a three-lead recording?
   a. Einthoven's triangle b. Wilson central terminal
   c. Limb leads d. Augmented leads

7. What does the "10-20" system refer to in electroencephalography (EEG) recording?
   a. The international standard for electrode placement on the scalp.
   b. The duration of an EEG recording session.
   c. The number of electrodes used for EEG measurement.
   d. The frequency range of brain waves recorded during an EEG.

8. What is the principle behind chemiluminescence-based biosensors?
   a. Measurement of electrical signals
   b. Detection of light emission during chemical reactions
   c. Utilization of radioactive isotopes
   d. Analysis of magnetic fields

9. What is the primary purpose of using EMG to study motor unit potentials (MUPs)?
   a. To measure the electrical activity of the brain
   b. To analyze the electrical activity of muscles during voluntary movements
   c. To assess the structural integrity of nerve fibers
   d. To monitor blood flow and oxygenation in muscle tissue

10. What is the primary purpose of telemetry in telemedicine?
   a. Transmitting medical data wirelessly
   b. Conducting virtual doctor-patient consultations
   c. Storing patient medical records electronically
   d. Monitoring patient vital signs remotely

11. Which brain wave pattern is most commonly associated with deep sleep stages in EEG recordings?
   a. Delta waves b. Beta waves c. Alpha waves d. Theta waves

12. What is the primary purpose of Human-Machine Interface (HMI) in a technological system?
   a. To enhance the communication and interaction between humans and machines
   b. To automate the operation of machines without human intervention
   c. To optimize the internal components and structure of machines
   d. To facilitate wireless connectivity between machines

13. Evoked potentials (EPs) are electrical signals generated by the nervous system in response to a _____ stimulus.
   a. Visual b. Auditory c. Auditory d. All of the mentioned

14. Neuropathy is
   a. Inflammation of the brain and spinal cord
   b. Degeneration of bone and joint tissues
   c. Damage or dysfunction of nerves
   d. Abnormal growth of blood vessel in eyes

15. Which of the following is an element involved in computer-assisted biofeedback signal processing?
   a. Data visualization b. Cell membrane potential
   c. Gene sequencing d. Magnetic resonance imaging (MRI)

16. Which of the following is a mode used in ultrasound (USG) imaging?
   a. Magnetic Resonance Imaging (MRI) b. Computed Tomography Imaging
   c. Doppler Imaging d. Positron Emission Tomography Imaging

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17. What is the primary working principle behind the generation of X-rays?
    a. Electromagnetic induction
    b. Photovoltaic effect
    c. Nuclear fission
    d. Bremsstrahlung radiation

18. What is the primary principle behind the functioning of an MRI scan?
    a. Transmission of sound waves through the body
    b. Measurement of electrical activity in the brain
    c. Detection of magnetic signals emitted by hydrogen atoms in the body
    d. Emission and absorption of X-rays by the body

19. What is the primary mechanism by which photocoagulation works in medical procedures?
    a. Chemical reaction
    b. Mechanical force
    c. Heat-induced
    d. Electrical stimulation

20. What is the fundamental principle behind the functioning of a CT-Scan?
    a. Magnetic resonance imaging
    b. X-ray absorption
    c. Ultrasound wave reflection
    d. Radioactive decay measurement