KATHMANDU UNIVERSITY
End Semester Examination
July/August, 2024

Marks Scored:

Level : B.E.
Year : III

Course : ETEG 321
Semester : II

Exam Roll No. :

Time: 30 mins.

F. M. : 10

Registration No.:

Date : 08 AUG 2024

SECTION "A"

[20 Q. × 0.5 = 10 marks]

Choose and encircle in the most appropriate option from each set of choices

1. Which component of the ECG waveform represents the depolarization of the atria?
   a. P wave b. QRS complex c. T wave d. ST segment

2. Which safety precaution is essential when performing X-rays?
   a. Using a high-frequency generator b. Wearing lead aprons and shields
   c. Increasing the exposure time d. Using a low contrast medium

3. What is a key advantage of MRI over CT scans?
   a. Lower cost b. Faster imaging time
   c. No exposure to ionizing radiation d. Better for imaging bones

4. What is the main advantage of a CT scan over a traditional X-ray?
   a. Lower radiation dose b. Ability to visualize soft tissues in detail
   c. Faster imaging process d. Less expensive

5. Evoked potentials are primarily used to diagnose which type of disorders?
   a. Cardiac disorders b. Neurological disorders
   c. Respiratory disorders d. Gastrointestinal disorders

6. What is telemetry primarily used for in a medical context?
   a. Remote patient monitoring b. Enhancing surgical precision
   c. Administering medication d. Improving diagnostic imaging

7. What is a key maintenance practice for ensuring the reliability of UPS systems in ICUs?
   a. Regular software updates b. Frequent battery testing and replacement
   c. Routine cleaning of equipment d. Installing antivirus software

8. Which type of wave is commonly associated with a relaxed, awake state in an EEG recording?
   a. Alpha waves b. Beta waves c. Delta waves d. Theta waves

9. Which of the following is a typical use of EMG in clinical practice?
   a. Diagnosing epilepsy b. Evaluating muscle and nerve function
   c. Monitoring fetal heart rate d. Assessing lung function

10. 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

11. 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

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

13. 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

14. What type of energy is used in photocoagulation to achieve the desired therapeutic effect?
a. Ultrasound b. Laser c. Electrical d. Magnetic

15. Evoked potentials (EPs) are electrical signals generated by the nervous system in response to a _____ stimulus.
a. Visual b. Auditory c. Sensory d. Any of the given

16. Which technique is used in biomedical signal processing to remove noise from signals?
a. Fourier Transform
b. Signal averaging
c. Histogram equalization
d. Image sharpening

17. 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.

18. The action potential of a neuron is primarily generated by the movement of which ions across the cell membrane?
a. Calcium and chloride
b. Sodium and potassium
c. Magnesium and phosphate
d. Hydrogen and bicarbonate

19. 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

20. Which of the following is a common safety standard for electrical medical equipment?
a. ISO 14001 b. IEEE 802.11 c. IEC 60601 d. ASME B16.5

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SECTION "B"
[4 Q. × 10 = 40 marks]

Attempt ANY FOUR questions. Each question carries 10 marks. Symbols have their usual meanings. Necessary assumptions are permissible. Marks are indicated inside brackets.

1. a. A patient is presented with a suspected brain tumor. What imaging modality would you recommend, a CT scan or an MRI? Justify your choice. [4]
   b. Relate ECG signal generation with the electrical activity of heart. [3]
   c. What is electrophysiology? Explain the mechanisms behind ionic potential generation in cells. [3]

2. a. Design a simple wearable device using the concept that you get from your course on Principle of Biomedical Engineering. Also, provide your concern on ISO standards. [4]
   b. Elaborate on the basic modes of transmission for USG. [3]
   c. What are the key elements of computer assisted bio-feedback signal processing? Give some examples. [3]

3. a. Explain limb leads of 12 lead-configuration of ECG. [3]
   b. Write short note on ampero-metric transducer. Elaborate on the application of transducers in the field of biomedical engineering with practical examples. [4]
   c. What are the best practices for maintaining and testing uninterrupted power supply within ICUs to ensure their reliability? [3]

4. a. Describe how EMG can be used to distinguish between neuropathic and myopathic disorders. [3]
   b. Describe the various technologies and tools used in telemedicine to facilitate remote diagnosis and treatment. [3]
   c. What are the electrical hazards concerning human? [2]
   d. Explain photo-thermal ablation. [2]

5. a. How can laser technology be utilized for therapeutic purposes? Discuss its effects on tissues. [3]
   b. Elaborate on different bands of EEG and relate those with the states of brain. [3]
   c. Explain human computer interface with example. [2]
   d. Elaborate on the usage of optical transducer in the field of biomedical engineering. [2]