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University of Ruhuna- Faculty of Technology

Bachelor of Biosystems Technology Honours Degree
Level 3 (Semester I) Examination, June/July 2025
Academic year 2023/2024

Course Unit: BST3142-Biomedical Technology (Written)

Duration: 1 & 1/2 hours

INSTRUCTIONS:

- Answer any three (3) out of the four questions provided.
- Use a separate answer booklet for your answers.
- Each question must begin on a new page.

1. Hearing assessment and assistive technologies play a crucial role in diagnosing and managing hearing impairments.

   a) Distinguish between air conduction and bone conduction in hearing assessment. ***(20 marks)***

   b) Compare the architecture and functional components of analogue and digital hearing aids. ***(30 marks)***

   c) How does digital signal processing (DSP) help hearing aids separate speech from background noise? Discuss how emerging technologies such as artificial intelligence (AI) can enhance this process by improving accuracy and personalization. ***(50 marks)***

   (Total-100 marks)

2. Effective patient monitoring plays a vital role in managing critically ill patients by enabling continuous assessment of vital signs.

   a) List four vital signs commonly monitored during surgery and explain their clinical significance. ***(20 marks)***

   b) Compare bedside and central station monitoring systems in terms of design, functions, and data handling. ***(30 marks)***

c) Discuss how technologies such as remote monitoring, AI, and real-time analytics are used in modern patient monitoring systems. What are the practical challenges of implementing these technologies in low-resource clinical environments?

(50 marks)

(Total-100 marks)

3. Modern healthcare relies heavily on medical imaging systems such as X-ray, CT, and MRI to detect, diagnose, and monitor a wide range of diseases.

   a) List three medical imaging systems and state one clinical use for each. *(20 marks)*

   b) Compare the principles of CT and MRI imaging, highlighting key features.

   (30 marks)

   c) Describe the mechanism of X-ray generation in an X-ray machine. In your answer, explain the difference between the two main types of X-ray tubes. *(50 marks)*

(Total-100 marks)

4. Biomedical signals are those signals which are used primarily for extracting information on a biological system under investigation.

   a) List five distinct categories of biomedical signals based on their underlying generation mechanism, including for each: physiological origin, fundamental physical nature, and example. *(30 marks)*

   b) Discuss key constraints which need to be considered in the design of a measurement system for medical applications. *(30 marks)*

   c) "Electrical hazards represent a critical risk category in biomedical instrumentation".

      i. Explain three pathophysiological impacts of electric current on the human body. *(20 marks)*

      ii. Discuss emerging technologies that mitigate these risks through novel isolation, monitoring, and design approaches. *(20 marks)*

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