1 Module Details

Module Name

Biomedical Electronics

Nominal duration

It is expected that students with the appropriate entry knowledge and skills will successfully complete this module in 36 to 40 hours.

Module code

NUE913

Discipline code

0703230

2 Module purpose

This module will provide students with an overview and basic understanding of monitoring, telemetry and calibration when using medical equipment involved in monitoring physiological parameters.

3 Prerequisites

Digital Electronics 2 (NE180)
Amplifiers 2 (NE183)

4 Relationship to competency standards

This module provides some of the knowledge and skills underpinning competency in the following standards:
National Electrotechnology Industry Standards, Units NES304, NES406, NES504 and the relevant specialisation.
Metals & Engineering Industry Standards, Units 18.56A, 18.57A, 18.58A, 18.65A, 18.66A.

5 Content

1. Transducers / Sensors
   - pressure
   - temperature
   - transcutaneous monitoring
   - fuel cells

2. Patient Isolation Circuits
   - level
   - standards

3. Defibrillation protection
   - standards
   - circuitry

4. Interference and noise reduction
   - equipment installation
   - 50Hz
   - RF
   - earthing
   - shielding

5. Measurement techniques

6. Data acquisition and sampling

7. Telemetry

8. Battery Management

6 Assessment strategy

Assessment methods	Assessment should be progressive reflecting a holistic approach to ensure the module purpose is met. To assist in ensuring validity, reliability and fairness assessment instruments should include practical exercises, assignments and written tests consisting of a number of item types, such as multiple choice, short answer and problem solving.
Conditions of assessment	Normally learning and assessment will take place in a classroom/laboratory.

7 Learning Outcome Details

Learning Outcome 1	Describe typical medical transducers and sensors.
Assessment criteria	1.1 State the reasons for the various types of sensors employed when monitoring body functions. 1.2 List typical transducers used in medical electronic applications. 1.3 Describe the operational principles of typical transducers used in medical applications. 1.4 List the types of equipment with which sensors interface and describe their function or purpose. 1.5 Describe special conditions of usage and sources of error which must be considered when using typical medical sensors. 1.6 List maintenance requirements (where appropriate). 1.7 Describe special storage and handling requirements (where applicable). 1.8 Describe infection control requirements in the input stages of medical monitoring equipment.
Learning Outcome 2	Describe patient isolation circuits.
Assessment criteria	2.1 State the need for patient isolation circuits. 2.2 Identify patient isolation circuits in typical medical monitoring equipment. 2.3 Describe the operating principles of various types of patient isolation circuitry. 2.4 State the most suitable isolation circuit for various applications. 2.5 Test isolation circuits.
Learning Outcome 3	Describe defibrillation protection in patient connected medical equipment.
Assessment criteria	3.1 State the need for protection at the input stages of patient connected medical monitoring equipment. 3.2 Describe the electrical characteristics of defibrillation pulses and the resulting protection circuit requirements. 3.3 Describe how typical defibrillation pulse protection circuitry operates. 3.4 State the need to ensure that defibrillation protected equipment as specified in AS3200 is used during defibrillation procedures.

Learning Outcome 4	Describe and demonstrate interference and noise reduction techniques.
Assessment criteria	4.1 List typical causes of noise and interference likely to be encountered when using medical equipment. 4.2 Describe how noise or interference manifests itself when using medical electronic equipment. 4.3 Describe strategies to reduce the impact of noise and interference in a typical situation. 4.4 Describe strategies that may be employed to reduce the impact of noise and interference in a medical situation. 4.5 Demonstrate techniques for minimising the impact of noise or interference when using various types of medical equipment.
Learning Outcome 5	Describe calibration and measurement techniques as applied to medical equipment.
Assessment criteria	5.1 Describe the basic principles of metrology. 5.2 Describe the possible impacts of various types of measurement inaccuracies. 5.3 Critically analyse the results of a medical equipment performance test.
Learning Outcome 6	Describe sampling and data acquisition techniques used in a medical environment
Assessment criteria	6.1 Define data acquisition and state how this is commonly achieved in various medical situations. 6.2 Define sampling and state why it is used. 6.3 Define the sampling period and list factors that determine its frequency. 6.4 Describe possible effects of choosing a sampling period that is too high or too low. 6.5 Describe typical data acquisition circuitry used in a medical environment 6.6 Describe the types of data that may be sampled in a medical situation. 6.7 List typical storage methods for data.
Learning Outcome 7	Describe the use of telemetry in a medical environment.
Assessment criteria	7.1 Describe the medical use of telemetry. 7.2 List available frequency bands and licensing requirements for RF telemetry environments. 7.3 List typical telemetry methods used in medical situations. 7.4 Describe common problems with telemetry installations.
Learning Outcome 8	Demonstrate battery management procedures.
Assessment criteria	8.1 List the various types of batteries found in common medical electronic equipment. 8.2 State typical shelf life of common batteries.

	8.3 List typical applications for common batteries. 8.4 State and describe hazards when working with, installing, and disposing of batteries. 8.5 Test common batteries. 8.6 Install batteries in common medical electronic equipment. 8.7 Test equipment for correct function after battery replacement. 8.8 Describe and use documentation employed in battery management.
8 Delivery of the module	
Delivery strategy	Delivery strategies must be suitable for learning both theoretical and practical aspects described in the module purpose. It is considered that the most effective way to achieve this is by the integration of theory and practice where students learn by experimentation and through research and laboratory reports. It is recommended that learning and assessment be facilitated in a holistic manner, which may require a learning outcome sequence other than that indicated in the module.
Resource requirements	Resources should be sufficient for students to carry out practical exercises in small groups. Useful references include: Carr, Joseph J., Brown John M. Introduction to Biomedical Equipment Technology, Third Edition, Prentice Hall, 1998. ISBN 0-13-849431-2 Carr, Joseph J. Biomedical Equipment - Use, Maintenance and Management, Prentice Hall, 1992. ISBN 0-13-257577-9
Occupational health and safety requirements	A safe and healthy environment will be provided for students and teachers as well as safety procedures followed with regard to teaching/learning activities.

