1 Module Details

Module Name	Electrophysiology
Nominal duration	It is expected that students with the appropriate entry knowledge and skills will successfully complete this module in 72 to 80 hours.
Module code	NUE911
Discipline code	0703230

2 Module purpose

This module provides students with an understanding of electrical activity within the human body, methods of monitoring this activity, and its relevance to clinical treatment. In addition the module provides students with knowledge of the relevant electrical safety standards governing patient microelectronic contact and the skills to apply the standards when undertaking clinical equipment commissioning and maintenance.

3 Prerequisites

Basic Principles of Anatomy and Physiology (NUE910)

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

- The cell and excitable tissues
- Neurophysiology and neural potentials
- Muscle physiology
- Cardiac physiology and the ECG
- Renal physiology and electrolyte balance
- Measurement of biological potentials
- Analysis of biological potentials and diagnosis
- Vital sign monitoring
- Safety and Safety Standards in a clinical setting
- Safety devices used in a clinical setting
- Monitoring and maintaining safety devices

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 the basic structure of eukaryotic cells and relate the structure of subcellular components to function.
Assessment criteria	1.1 Identify the main components of the cell and briefly state the primary functions of: - cell membrane - cytoplasm - nucleus - mitochondrion - endoplasmic reticulum - Golgi complex - ribosomes - lysosomes - cytoskeleton
Learning Outcome 2	Describe the chemical nature of living material, with particular reference to ions and electrical properties.
Assessment criteria	2.1 Describe the chemical composition and electrical properties of the cell membrane, cytoplasm, and extracellular fluid. 2.2 Describe the ions associated with the intra- and extracellular compartments.
Learning Outcome 3	Explain the basis and significance of the membrane potential.
Assessment criteria	3.1 Describe the major forms of transmembrane transport, and explain their significance in cell function. 3.2 Explain the ionic and molecular basis for the resting membrane potential.
Learning Outcome 4	Explain the basis of excitability in tissues.
Assessment criteria	4.1 Describe the types of ionic channels found in most cells. 4.2 Explain the roles of ligand activated and voltage activated channels in the alteration of membrane resistance. 4.3 Explain what is meant by excitable tissue, giving common examples.
Learning Outcome 5	Explain the ionic basis of the action potential and the mechanism of synaptic transmission.
Assessment criteria	5.1 Explain the ionic basis of the action potential. 5.2 Describe the mechanism of excitatory and inhibitory influences on neural activity. 5.3 Explain the ionic basis of nerve conduction in both myelinated and unmyelinated fibres. 5.4 Describe the general ultrastructure of both chemical

	and electrical synapses. 5.5 Explain the mechanism of both chemical and electrical synaptic transmission in terms of ionic flux.
Learning Outcome 6	Explain how ionic flux is used to control biological processes, with particular reference to nerve and muscle.
Assessment criteria	6.1 Describe how depolarisation leads to muscle contraction. 6.2 Explain the role of the T-tube in muscle contraction. 6.3 Describe the histology of cardiac muscle. 6.4 Explain the ionic basis of the intrinsic rhythmicity of cardiac muscle cells. 6.5 Describe the anatomy and function of the cardiac conduction system. 6.6 Describe the normal ECG, and explain its origin. 6.7 Describe some of the common pathologies of the heart with particular reference to their influence on the ECG. 6.8 Explain the contribution of the kidneys and other systems to the maintenance of normal electrolyte levels and pH in the body. 6.9 Explain the importance of the maintenance of normal electrolyte levels and pH in the function of excitable tissues. 6.10 Describe the effects of disturbances in calcium, magnesium and potassium levels on the functions of the nervous system, muscle and heart.
Learning Outcome 7	Describe how voltage changes in tissues may be measured, both directly and indirectly.
Assessment criteria	7.1 Describe the basic methods used to directly measure biological potentials. 7.2 Describe the basic methods used to indirectly measure biological potentials. 7.3 Explain some of the limitations on both direct and indirect measurement of biological potentials.
Learning Outcome 8	Explain the biological basis of electrocution and relate this to defibrillation.
Assessment criteria	8.1 Describe the effect of transmembrane currents on excitable cells. 8.2 Explain the physiological basis of electrocution. 8.3 Explain the ionic basis of electrical burns. 8.4 Describe the physiological condition, and consequences of, ventricular fibrillation. 8.5 Explain the physiological basis of defibrillation.
Learning Outcome 9	Describe how the measure of voltage changes in tissues may be used in clinical practice, with particular reference to the ECG and EEG.

Assessment criteria	9.1 Describe a range of clinical applications of the measurement of biological potentials. 9.2 Describe the ionic basis of the ECG and the EEG. 9.3 Describe how the ECG and the EEG may be used in clinical diagnosis. 9.4 Explain the physiological basis of auditory evoked potentials. Why are auditory evoked potentials useful in clinical practice. 9.5 Describe what is meant by a vital sign. 9.6 Describe the clinical situations where the monitoring of vital signs might be useful. 9.7 Explain how the monitoring of vital signs might be useful in clinical diagnosis.
Learning Outcome 10	Apply approved electrical safety standards in the workplace, and explain how appropriate standards are to be met.
Assessment criteria	10.1 Describe the various types of safety devices used to to protect the patient during monitoring procedures. 10.2 Identify situations in which patients may be exposed to serious electrical hazards. 10.3 Explain the operation of the common types of safety devices in clinical use. 10.4 Describe the standards applicable to patient safety in relation to electromedical equipment. 10.5 Describe the legal documentation necessary when dealing with equipment in contact, or potentially in contact, with the patient.

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 on an individual basis. Useful references include: Marieb, E.N., Study Guide to Accompany Human Anatomy and Physiology, 4th Edition, Benjamin/Cummings, Sydney, 1995.
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.