1 Module Details

Module Name

Common Medical Equipment 1

Nominal duration

It is expected that students with the appropriate entry knowledge and skills will successfully complete this module in 54 to 60 hours.

Module code

NUE915

Discipline code

0703230

2 Module purpose

This module provides students with knowledge of the clinical function, application, hazards and common faults of a diverse range of common medical equipment eg. Physiological Monitors, Defibrillators, Incubators, Gas Monitors. In addition, the module provides students with the skills to perform functional verification of the equipment to AS3551.

3 Prerequisites

Basic Principles of Anatomy and Physiology (NUE910)
Microbiology of Infection Control (NUE912)

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. Physiological Monitors
   - function
   - physiological parameters monitored in the following medical areas:
     - GP Rooms
     - Hospital Outpatient Department
     - A&E Department
     - General Ward Areas
     - Coronary Care Unit
     - Intensive Care Unit (Adult)
     - Intensive Care Unit (Neonatal)
     - Respiratory Laboratory
     - Epilepsy Assessment Laboratory
     - Cardiac Investigation Laboratory
     - Maternity Unit
     - Dental and Oral Surgical Unit
     - Vascular Clinic
     - Urological Investigation Unit
     - Eye Clinic
     - Clinical Neurophysiology Unit
     - Gastroenterology Unit
     - Hyperbaric Medicine Unit
     - Dialysis Unit
     - Operating Theatre (General)
     - Operating Theatre (Cardio-Thoracic)
     - Operating Theatre (Neurosurgery)
   - hazards
   - monitoring configurations

- modular
- configured

- display and recording methods
- common faults
- functional verification to AS3551

2. Defibrillators
   - development and application
   - function
   - principles of operation
   - defibrillator waveforms
   - hazards
   - functional verification to AS3551

3. Infusion Pumps
   - clinical function
   - delivery mechanisms – advantages and disadvantages
     - cartridges
     - peristaltic tubes
     - rigid piston / floppy bag
     - syringes
   - flow-rate and occlusion pressure verification
   - functional verification to AS3551

4. Incubators
   - function
   - temperature control
   - principles of operation
   - transport requirements
   - common faults
   - functional verification to AS3551

5. Foetal Monitors
   - clinical application
   - principles of operation
   - common faults
   - functional verification to AS3551

6. Anaesthetic Units
   - clinical aaplication
   - principles of operation
   - hazards
     - patient
     - operator
   - common equipment faults
   - functional verification to AS3551 & AS4059

7. Gas Monitors
   - clinical application
   - principles of operation
   - application
   - hazards
   - common faults
   - functional verification to AS3551

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 operation of **Physiological Monitoring Equipment** with regard to function, application, hazards and common faults and perform functional verification to AS3551

Assessment criteria

1.1 Outline the necessity for monitoring physiological parameters and the types of clinical procedures that may require physiological monitoring.

1.2 List the physiological parameters that are commonly monitored in the medical areas of a large hospital.

1.3 State the eight most commonly monitored physiological parameters, and list the measurement accuracy required for each of these parameters.

1.4 Explain the characteristic bandwidths required to record these commonly encountered signals and the methods used to extract these signals from the patient.

1.5 Describe, for electronic signals, the amplification method used and the importance of filtering and noise rejection.

1.6 Describe the effect of potential hazards on measurement accuracy.

1.7 Describe the electrical hazards associated with invasive monitoring and common methods of reducing them.

1.8 Describe the commonly available display and recording methods including data gathering and processing.

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	1.10 List the advantages and disadvantages of vacuum tube and solid-state displays with particular reference to clinical usage.
	1.11 List the essential safety and performance parameters, which should be tested and documented for the commonly measured physiological parameters and specify the required test equipment.
	1.12 Describe the procedures for safety and functional testing to AS3551.
Learning Outcome 2	Describe the operation of **defibrillators** with regard to their function, hazards and common faults and perform functional verification to AS3551.
Assessment criteria	2.1 Describe the development and applications of modern defibrillators.
	2.2 State the function of defibrillators and describe the physiological effects of defibrillator usage.
	2.3 Draw a block diagram and describe the operating principles of a defibrillator.
	2.4 Describe commonly used defibrillator waveforms and the effects of each type.
	2.5 List hazards associated with defibrillator servicing and improper defibrillator use.
	2.6 Describe causes of defibrillator failure including: - Patient non-response - Waveform efficacy - Electronics faults - User errors
	2.7 Perform the functional verification of defibrillator operation appropriate to AS3551.
Learning Outcome 3	Describe different types of **infusion pumps** with regard to their function, application and common faults and perform functional verification to AS3551.
Assessment criteria	3.1 State the clinical functions of infusion pumps.
	3.2 List and describe the types and applications of infusion pumps.
	3.3 Describe the advantages and disadvantages of various delivery mechanisms including cartridges, peristaltic tubes, rigid piston / floppy bag, syringes, in terms of air detection, free flow, delivery accuracy and occlusion detection.

	3.4 Describe typical test set-ups for flow-rate and occlusion pressure verification.
	3.5 Describe common user and electrical / mechanical faults.
	3.6 Perform the functional verification of an infusion pump according to AS3551.
Learning Outcome 4	Describe the operation of **infant incubators** with regard to function, applications, hazards and common faults and perform functional verification to AS3551.
Assessment criteria	4.1 Describe the physiological importance of temperature control of incubators including the effect of haemolysis and surface/volume ratio of the infant.
	4.2 Describe the operating principles of incubators and common types of temperature control, including primary thermostat, over temperature cutout, temperature measuring locations, air circulation and “air curtain”.
	4.3 Describe common failures of incubators including thermo-regulation, fans and bearings, housings, plastics and seals.
	4.4 Describe the particular requirements for transport incubators including power supplies, compatible monitoring, gas supplies and transport safety.
	4.5 Perform and document the functional verification of an incubator including temperature verification and indication, over temperature cutout, alarms function and noise level to AS3551.
Learning Outcome 5	Describe the operation of **Foetal Cardio-Tocograph (CTG)** equipment with regard to function, application, hazards and common faults and functional verification to AS3551.
Assessment criteria	5.1 State the clinical application of CTG.
	5.2 Describe the principles of operation of CTG equipment and typical outputs.
	5.3 Describe common faults in the operation of CTG equipment.
	5.4 Describe data acquisition and management systems which may be connected to CTG and other obstetric monitoring equipment.
	5.5 List the essential safety and performance parameters which should be tested and documented, and specify the test equipment

	required for testing. 5.6 Describe the procedure for safety and functional testing to AS3551.
Learning Outcome 6	Describe an **anaesthetic unit** (and associated equipment) with regard to function, application, hazards and common faults, and perform functional verification to AS3551& AS4059.
Assessment criteria	6.1 Outline the situations, which necessitate the use of an anaesthetic unit and the physiology of general anaesthesia. 6.2 Describe the operating principles of anaesthetic units and the built-in safeguards, using a gas flow block diagram. 6.3 State the possibilities of operator error in the administration of general anaesthesia, and the clinical implications of such errors. 6.4 Describe the common equipment faults of anaesthetic units and potential remedial action which can be undertaken during usage. 6.5 Describe the patient and operator hazards specific to general anaesthesia. 6.6 List the essential safety and performance parameters, which should be tested and documented, and specify the test equipment required for testing. 6.7 Describe the procedure for safety and functional testing to AS3551 & AS4059.
Learning Outcome 7	Describe the various **gas monitors** used in respiratory circuits with regard to function, application, hazards and common faults, and perform functional verification to AS3551. 7.1 Outline the clinical situations which necessitate the monitoring of respiratory gases, and the use of such monitoring. 7.2 Describe the principles of operation of the various types of gas monitor, the specific modes of operation and the potential for inconclusive results. 7.3 Describe the clinical responses which may be undertaken, and the patient treatment strategies which might be influenced by gas monitoring information. 7.4 List the common sources of erroneous readings on

	gas monitors. 7.5 List the essential safety and performance parameters which should be tested and documented, and specify the test equipment required for testing. 7.6 Perform and document the functional verification of gas monitors to AS3551.
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. This will require access to the relevant medical equipment. 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 Useful references include a range of manufacturers operational and maintenance manuals for relevant medical equipment.
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.

